Fig. 1

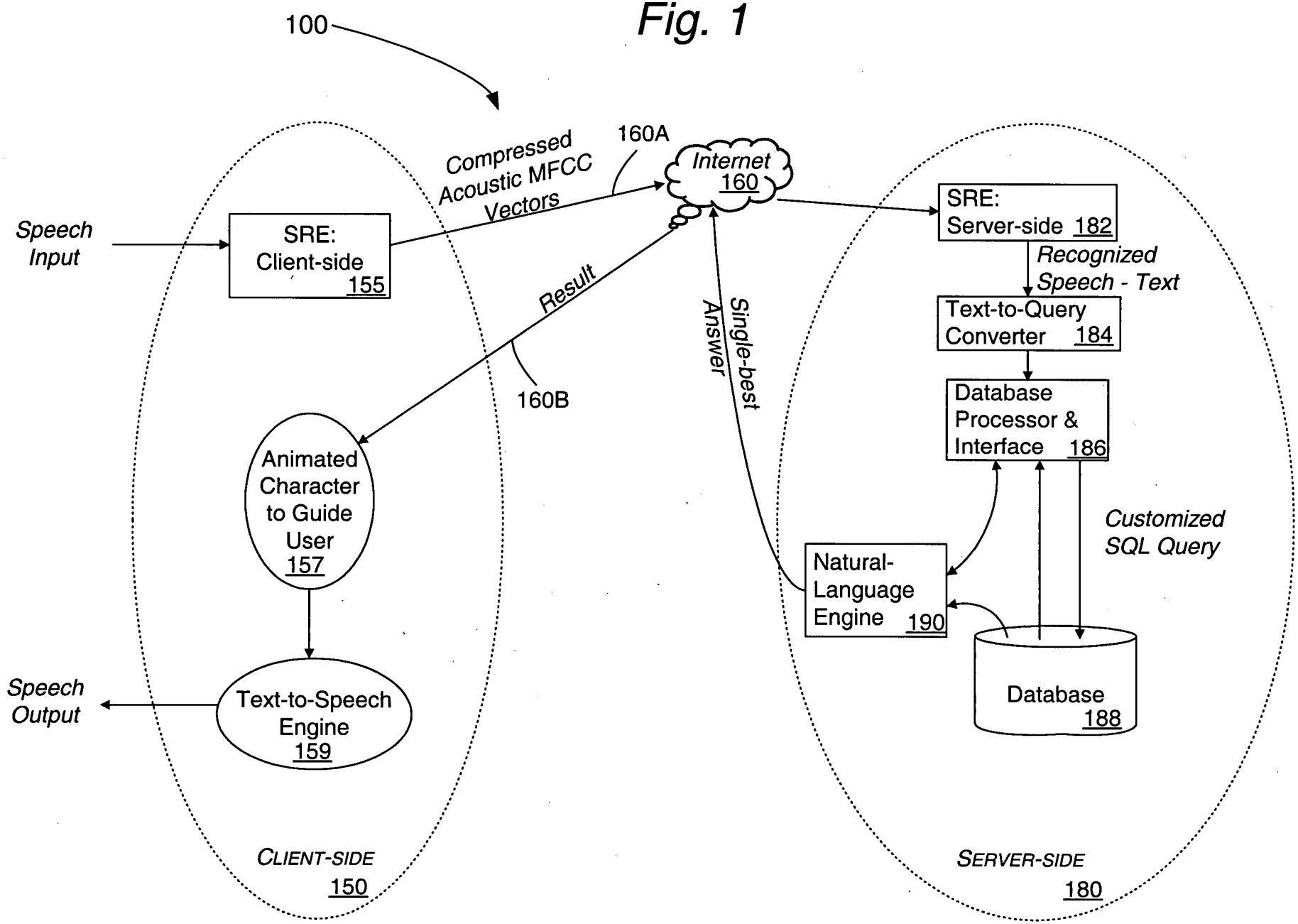

100
Speech Input
SRE: Client-side 155
Compressed Acoustic MFCC Vectors
160A
Internet 160
SRE: Server-side 182
Recognized Speech - Text
Text-to-Query Converter 184
Database Processor & Interface 186
Customized SQL Query
Result
160B
Single-best Answer
Animated Character to Guide User 157
Natural-Language Engine 190
Database 188
Speech Output
Text-to-Speech Engine 159
CLIENT-SIDE 150
SERVER-SIDE 180

Figure 2A

CLIENT-SIDE SYSTEM LOGIC

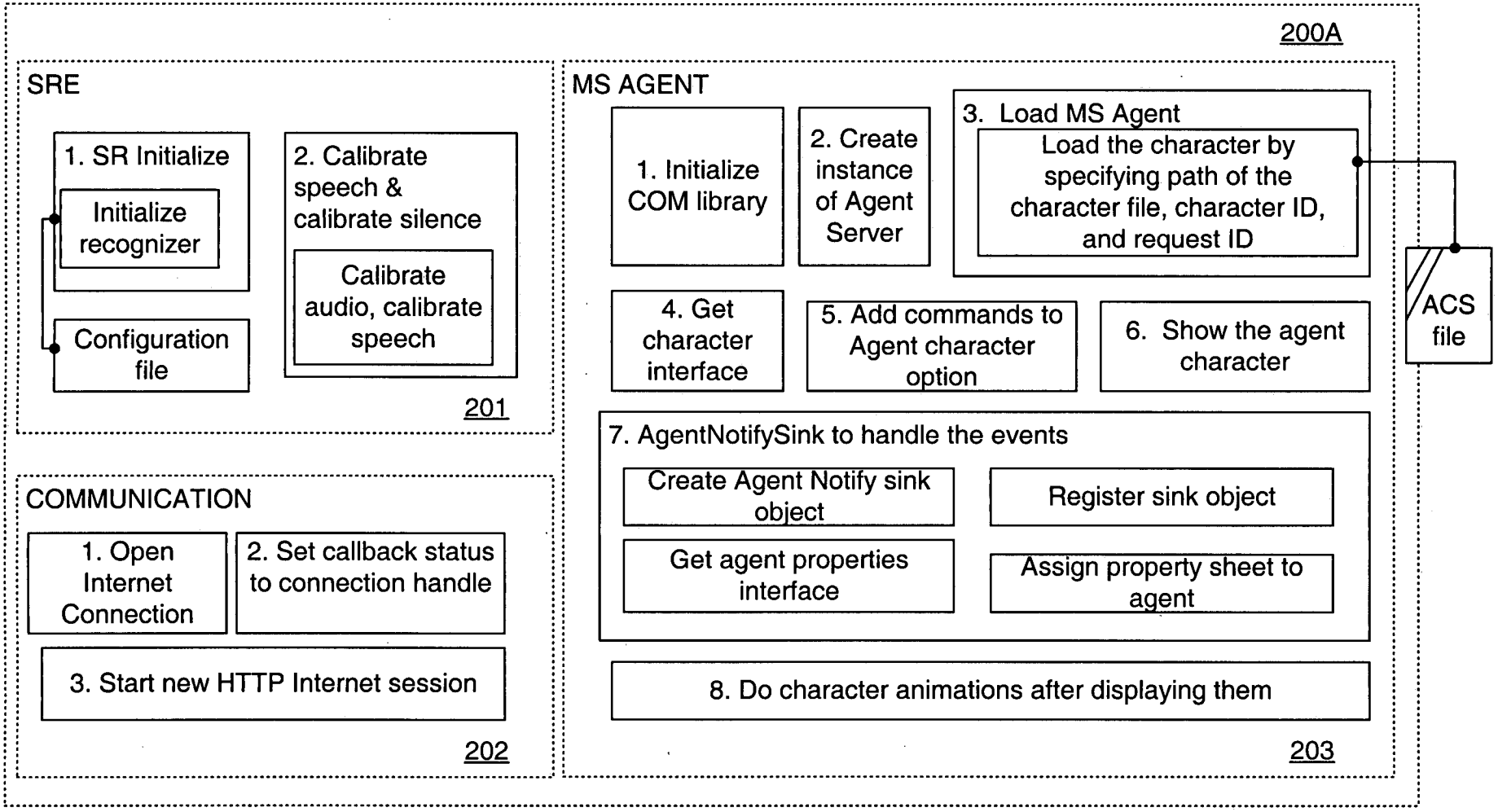

200A
SRE
1. SR Initialize
Initialize recognizer
Configuration file
2. Calibrate speech & calibrate silence
Calibrate audio, calibrate speech
201
COMMUNICATION
1. Open Internet Connection
2. Set callback status to connection handle
3. Start new HTTP Internet session
202
MS AGENT
1. Initialize COM library
2. Create instance of Agent Server
3. Load MS Agent
Load the character by specifying path of the character file, character ID, and request ID
ACS file
4. Get character interface
5. Add commands to Agent character option
6. Show the agent character
7. AgentNotifySink to handle the events
Create Agent Notify sink object
Register sink object
Get agent properties interface
Assign property sheet to agent
8. Do character animations after displaying them
203

Figure 2B

CLIENT-SIDE SYSTEM LOGIC

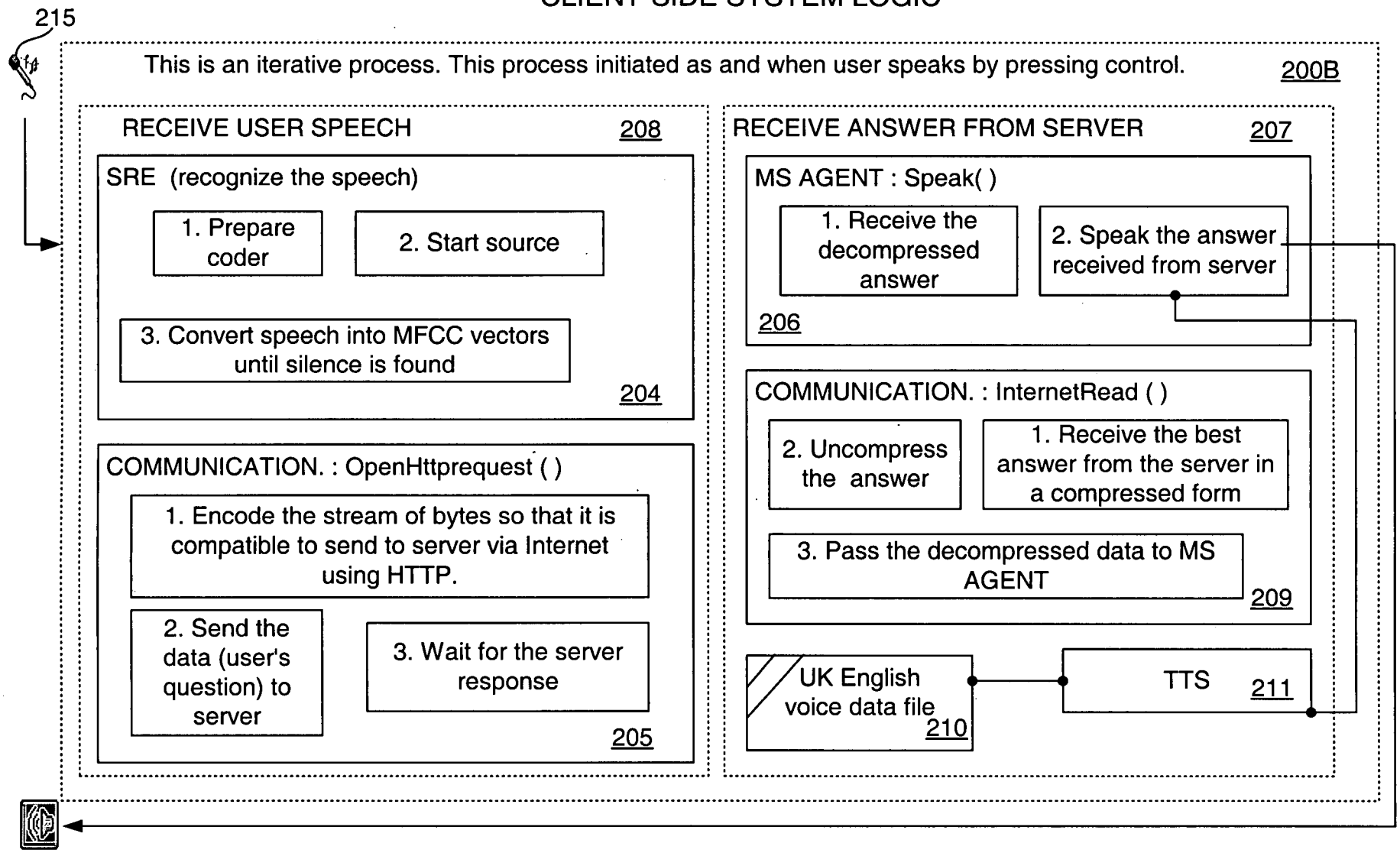

215
This is an iterative process. This process initiated as and when user speaks by pressing control.
200B
RECEIVE USER SPEECH
208
SRE (recognize the speech)
1. Prepare coder
2. Start source
3. Convert speech into MFCC vectors until silence is found
204
COMMUNICATION. : OpenHttprequest ( )
1. Encode the stream of bytes so that it is compatible to send to server via Internet using HTTP.
2. Send the data (user's question) to server
3. Wait for the server response
205
RECEIVE ANSWER FROM SERVER
207
MS AGENT : Speak( )
1. Receive the decompressed answer
2. Speak the answer received from server
206
COMMUNICATION. : InternetRead ( )
2. Uncompress the answer
1. Receive the best answer from the server in a compressed form
3. Pass the decompressed data to MS AGENT
209
UK English voice data file
210
TTS
211

Figure 2C

CLIENT-SIDE SYSTEM LOGIC

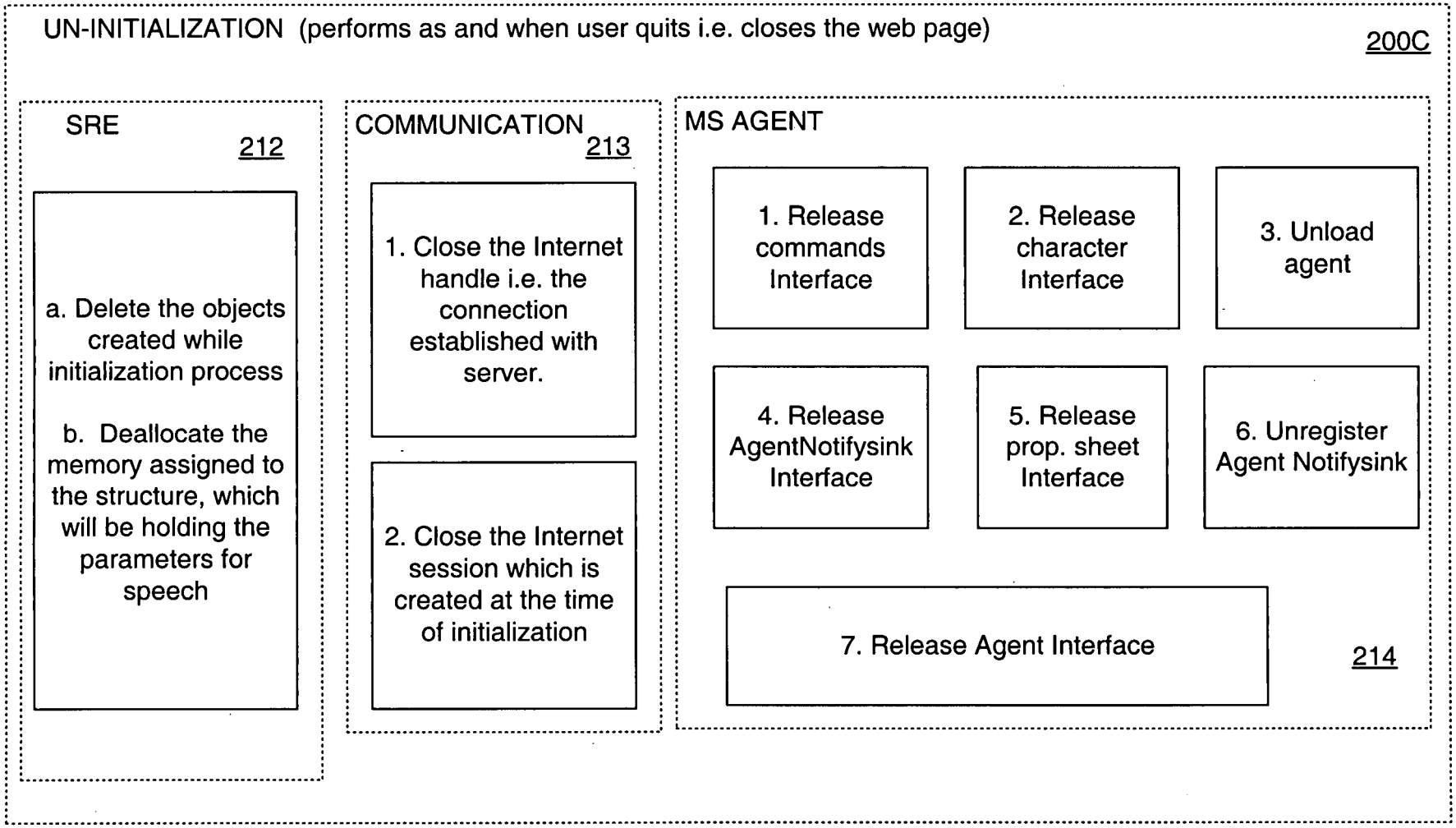

UN-INITIALIZATION (performs as and when user quits i.e. closes the web page)
200C
SRE
212
a. Delete the objects created while initialization process
b. Deallocate the memory assigned to the structure, which will be holding the parameters for speech
COMMUNICATION
213
1. Close the Internet handle i.e. the connection established with server.
2. Close the Internet session which is created at the time of initialization
MS AGENT
1. Release commands Interface
2. Release character Interface
3. Unload agent
4. Release AgentNotifysink Interface
5. Release prop. sheet Interface
6. Unregister Agent Notifysink
7. Release Agent Interface
214

Fig. 2D

Cli nt-sid Initialization

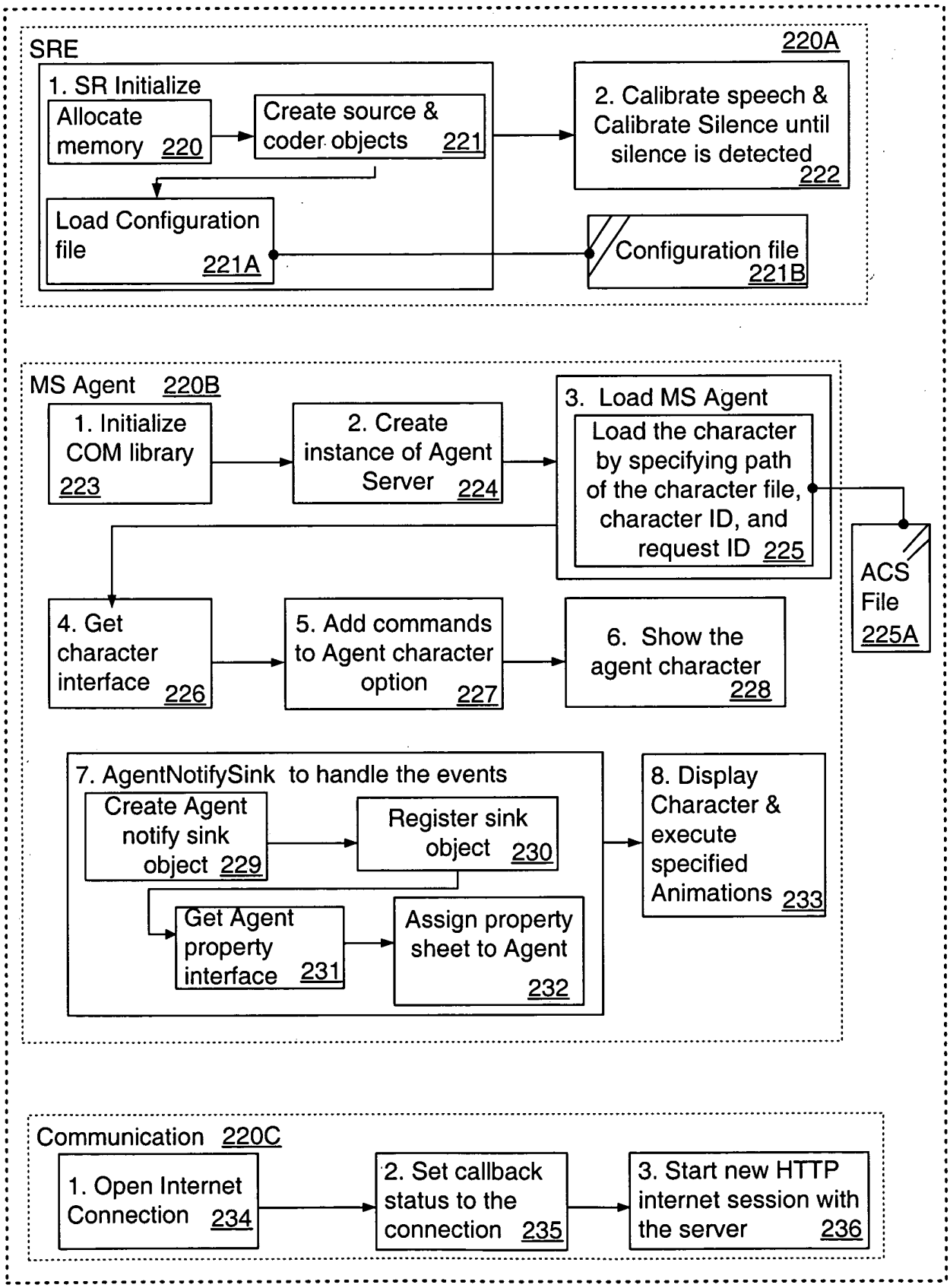

SRE
220A
1. SR Initialize
Allocate memory 220
Create source & coder objects 221
2. Calibrate speech & Calibrate Silence until silence is detected 222
Load Configuration file 221A
Configuration file 221B
MS Agent 220B
1. Initialize COM library 223
2. Create instance of Agent Server 224
3. Load MS Agent
Load the character by specifying path of the character file, character ID, and request ID 225
ACS File 225A
4. Get character interface 226
5. Add commands to Agent character option 227
6. Show the agent character 228
7. AgentNotifySink to handle the events
Create Agent notify sink object 229
Register sink object 230
Get Agent property interface 231
Assign property sheet to Agent 232
8. Display Character & execute specified Animations 233
Communication 220C
1. Open Internet Connection 234
2. Set callback status to the connection 235
3. Start new HTTP internet session with the server 236

Fig. 3

Client-side It rative Process

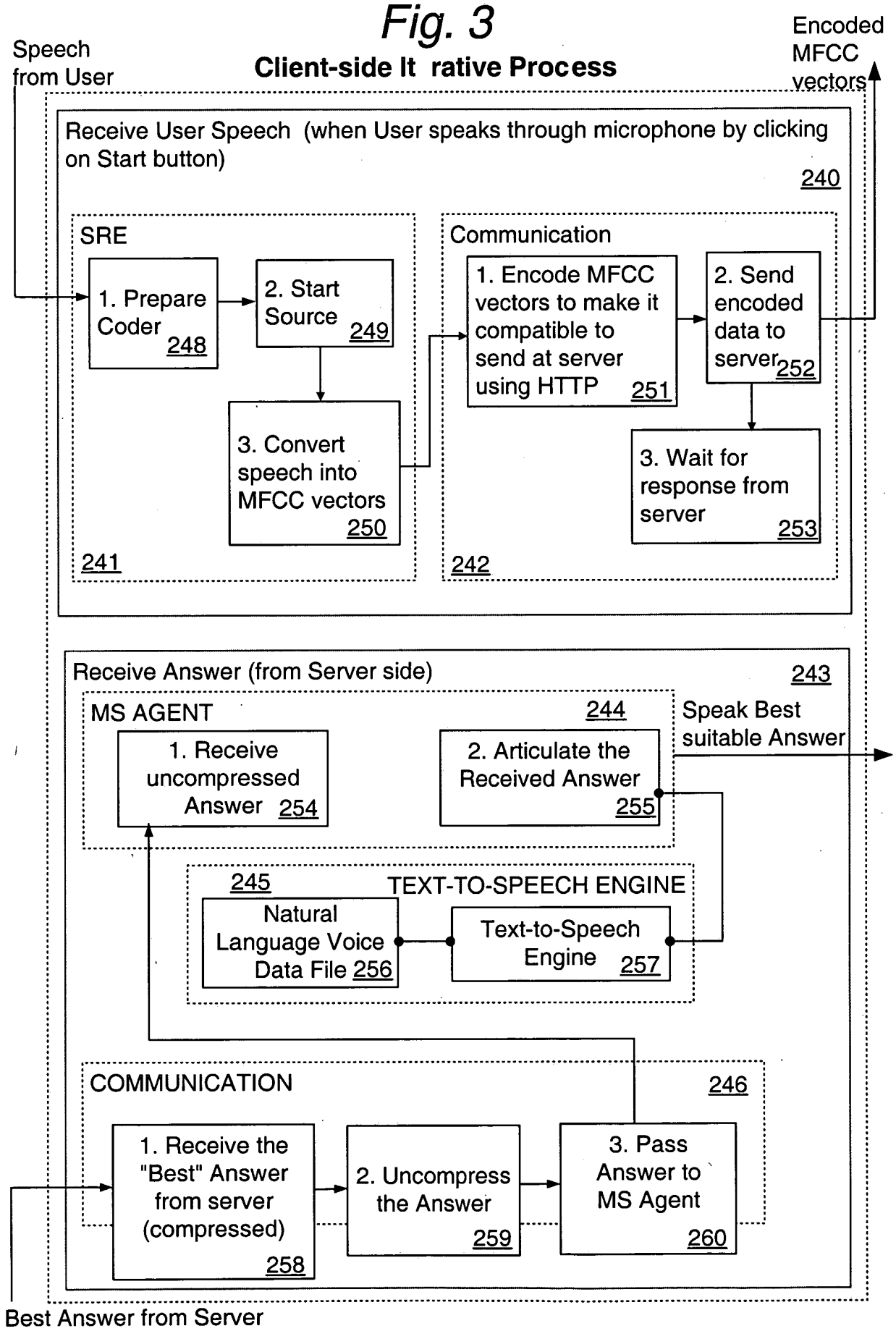

Speech from User
Encoded MFCC vectors
Receive User Speech (when User speaks through microphone by clicking on Start button)
240
SRE
1. Prepare Coder 248
2. Start Source 249
3. Convert speech into MFCC vectors 250
241
Communication
1. Encode MFCC vectors to make it compatible to send at server using HTTP 251
2. Send encoded data to server 252
3. Wait for response from server 253
242
Receive Answer (from Server side)
243
MS AGENT
244
1. Receive uncompressed Answer 254
2. Articulate the Received Answer 255
Speak Best suitable Answer
245
TEXT-TO-SPEECH ENGINE
Natural Language Voice Data File 256
Text-to-Speech Engine 257
COMMUNICATION
246
1. Receive the "Best" Answer from server (compressed) 258
2. Uncompress the Answer 259
3. Pass Answer to MS Agent 260
Best Answer from Server

Fig. 4

Client-side Un-Initialization

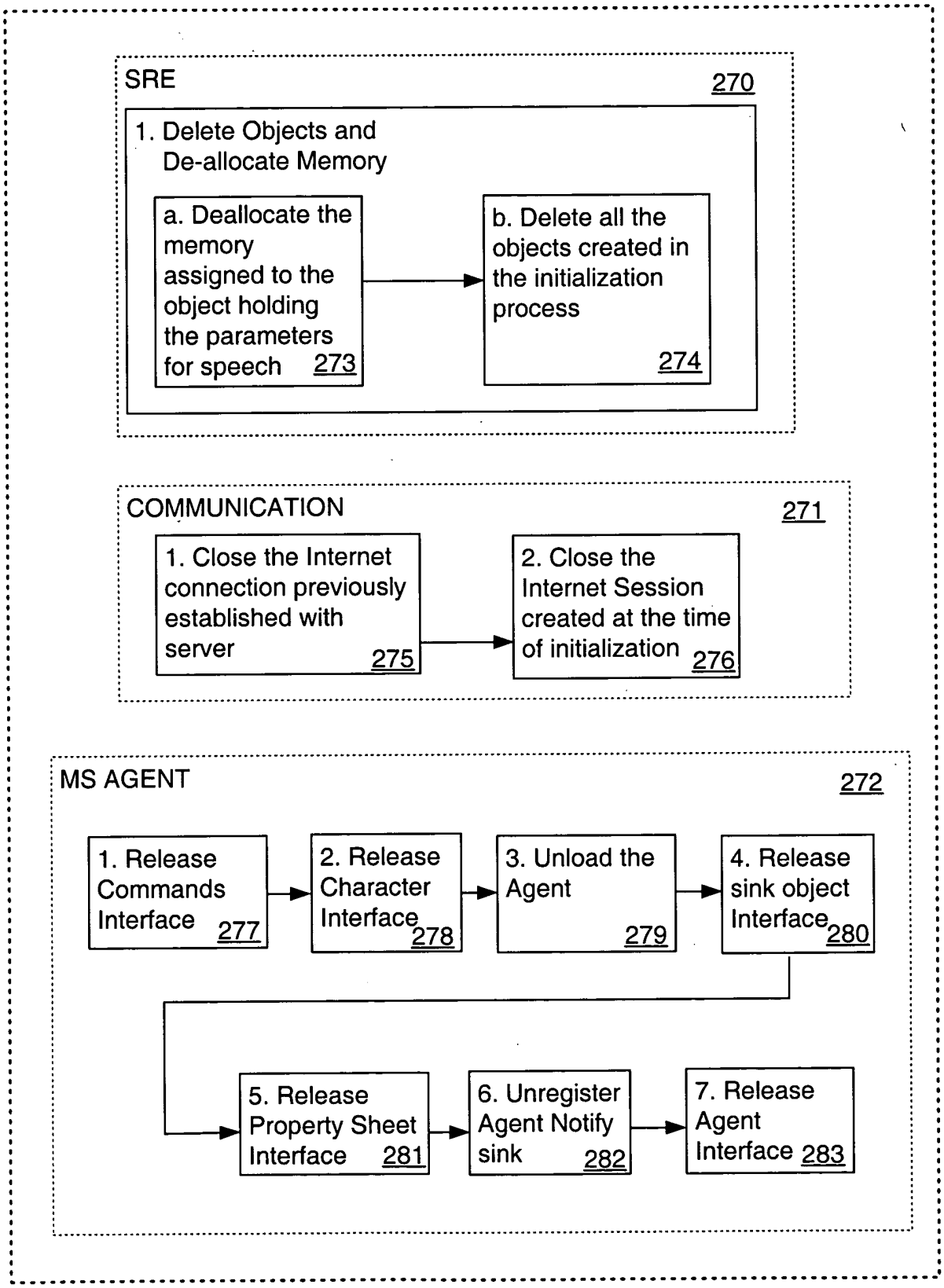
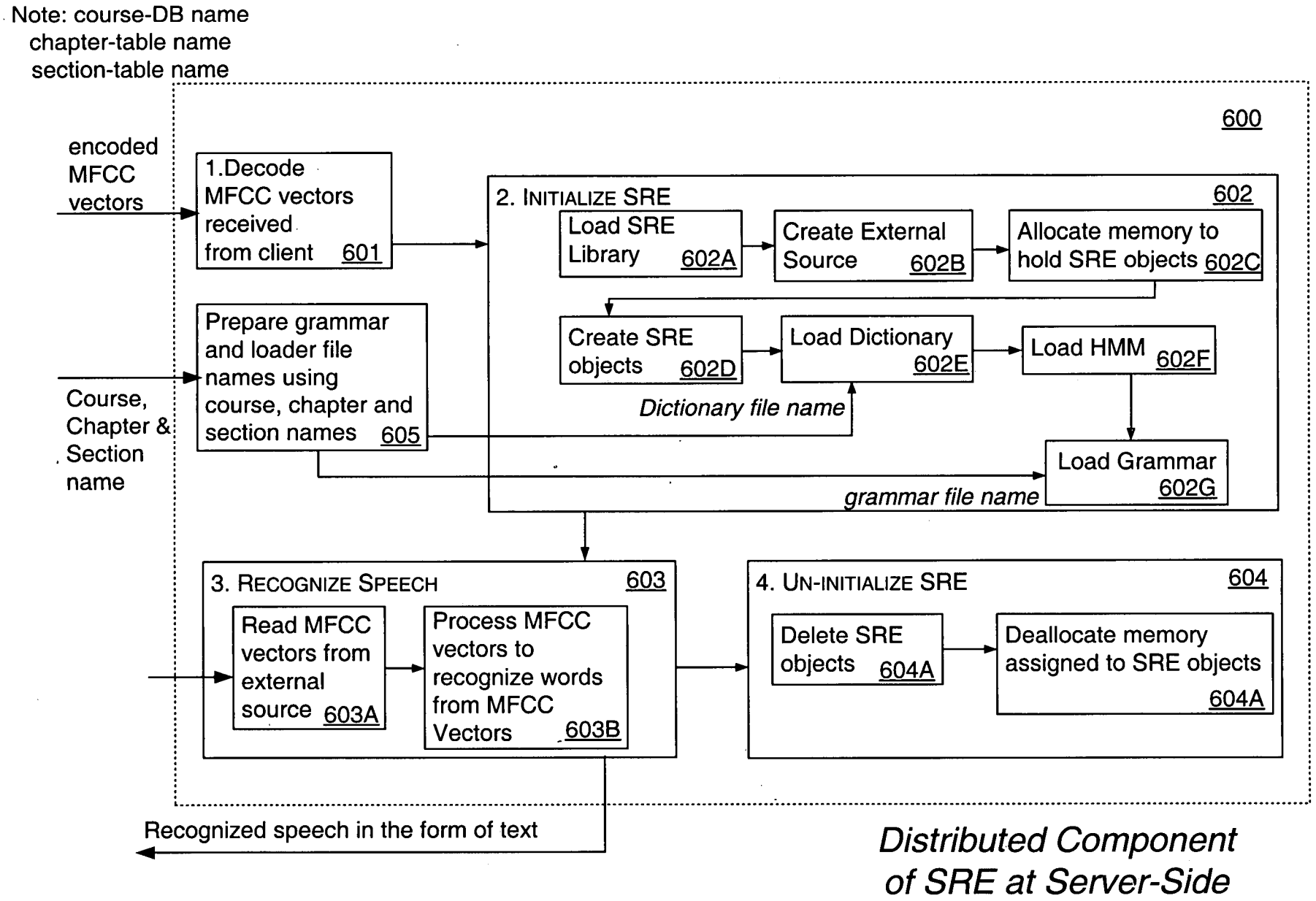

SRE
270
1. Delete Objects and De-allocate Memory
a. Deallocate the memory assigned to the object holding the parameters for speech 273
b. Delete all the objects created in the initialization process 274
COMMUNICATION
271
1. Close the Internet connection previously established with server 275
2. Close the Internet Session created at the time of initialization 276
MS AGENT
272
1. Release Commands Interface 277
2. Release Character Interface 278
3. Unload the Agent 279
4. Release sink object Interface 280
5. Release Property Sheet Interface 281
6. Unregister Agent Notify sink 282
7. Release Agent Interface 283

Fig. 4A


Note: course-DB name
chapter-table name
section-table name
600
encoded MFCC vectors
1.Decode MFCC vectors received from client 601
2. INITIALIZE SRE
602
Load SRE Library 602A
Create External Source 602B
Allocate memory to hold SRE objects 602C
Create SRE objects 602D
Load Dictionary 602E
Load HMM 602F
Dictionary file name
Prepare grammar and loader file names using course, chapter and section names 605
Course, Chapter & Section name
Load Grammar 602G
grammar file name
3. RECOGNIZE SPEECH
603
Read MFCC vectors from external source 603A
Process MFCC vectors to recognize words from MFCC Vectors 603B
4. UN-INITIALIZE SRE
604
Delete SRE objects 604A
Deallocate memory assigned to SRE objects 604A
Recognized speech in the form of text

Distributed Component of SRE at Server-Side

Fig. 4B

Build of SQL Query

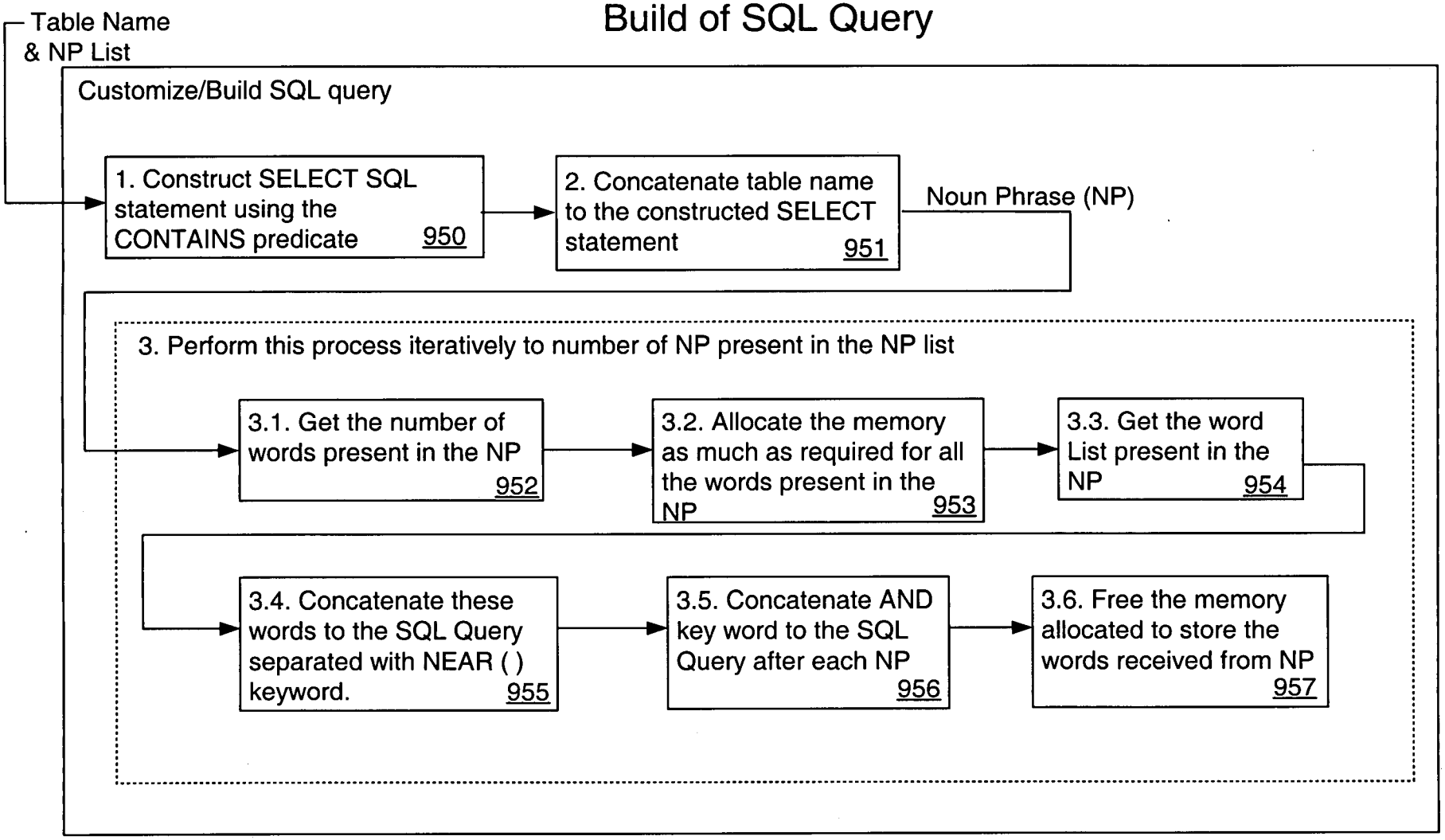


Table Name
& NP List
Customize/Build SQL query
1. Construct SELECT SQL statement using the CONTAINS predicate 950
2. Concatenate table name to the constructed SELECT statement 951
Noun Phrase (NP)
3. Perform this process iteratively to number of NP present in the NP list
3.1. Get the number of words present in the NP 952
3.2. Allocate the memory as much as required for all the words present in the NP 953
3.3. Get the word List present in the NP 954
3.4. Concatenate these words to the SQL Query separated with NEAR ( ) keyword. 955
3.5. Concatenate AND key word to the SQL Query after each NP 956
3.6. Free the memory allocated to store the words received from NP 957

Fig. 4C

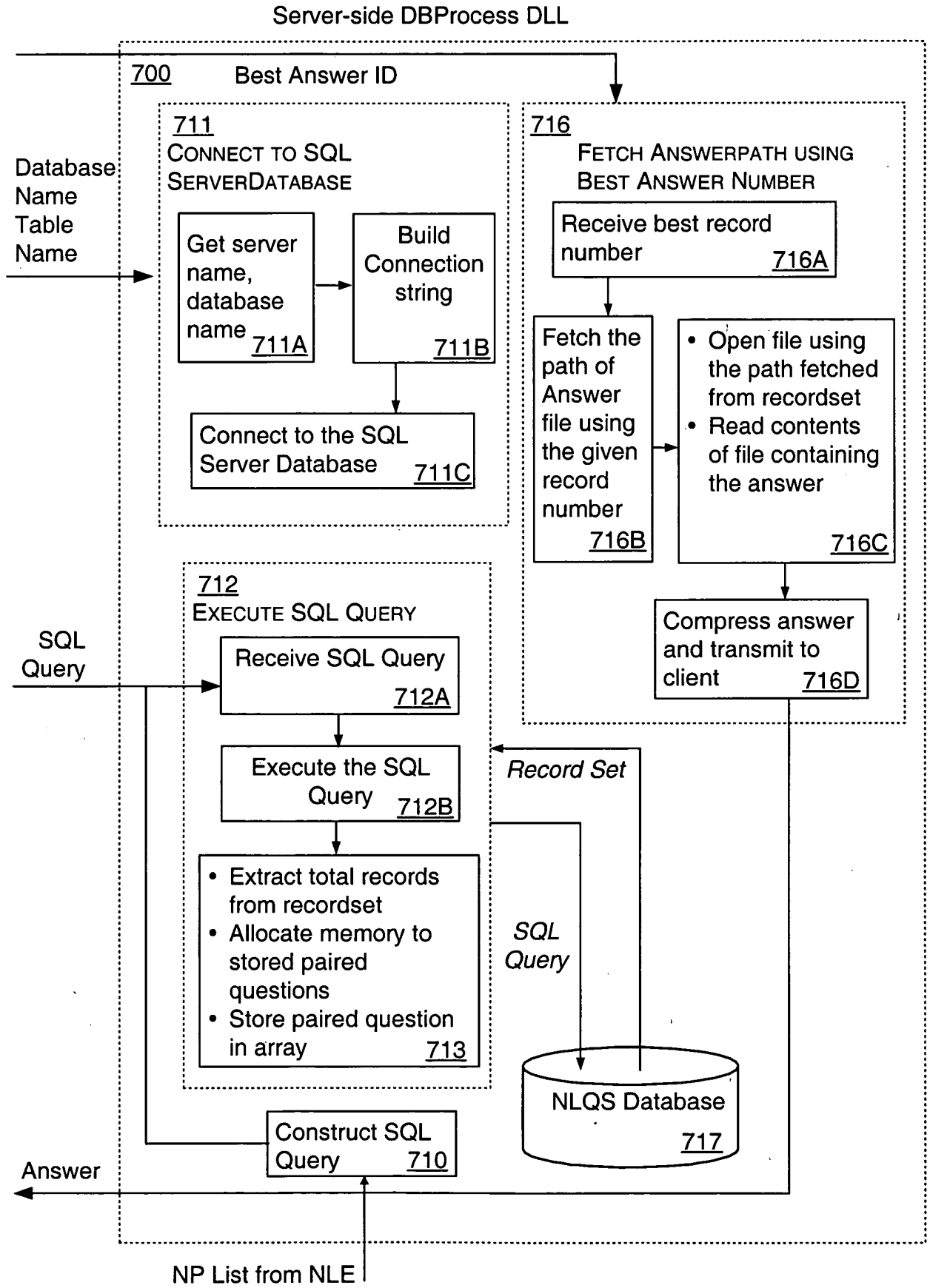

Server-side DBProcess DLL
700
Best Answer ID
711
CONNECT TO SQL SERVERDATABASE
Database Name
Table Name
Get server name, database name 711A
Build Connection string 711B
Connect to the SQL Server Database 711C
716
FETCH ANSWERPATH USING BEST ANSWER NUMBER
Receive best record number 716A
Fetch the path of Answer file using the given record number 716B
• Open file using the path fetched from recordset
• Read contents of file containing the answer 716C
Compress answer and transmit to client 716D
712
EXECUTE SQL QUERY
SQL Query
Receive SQL Query 712A
Execute the SQL Query 712B
Record Set
• Extract total records from recordset
• Allocate memory to stored paired questions
• Store paired question in array 713
SQL Query
NLQS Database 717
Construct SQL Query 710
Answer
NP List from NLE

Fig. 4D

Note: PQ - Paired Question
NP- Noun Phrase
Red Line - I / O

Interface Logic betwe n NLE and DBProcess.DLL

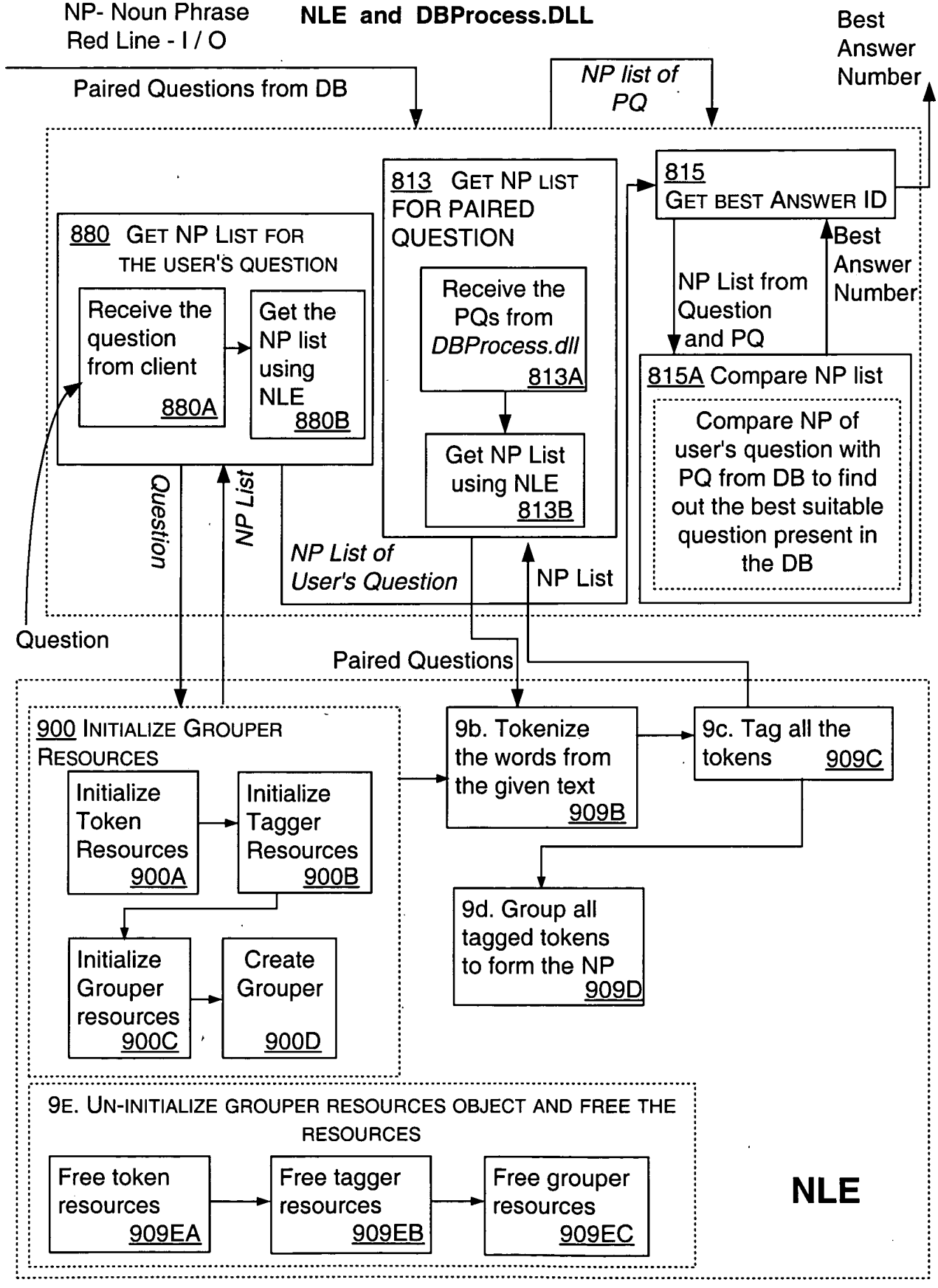

Best Answer Number
Paired Questions from DB
NP list of PQ
813 GET NP LIST FOR PAIRED QUESTION
Receive the PQs from DBProcess.dll 813A
Get NP List using NLE 813B
815 GET BEST ANSWER ID
NP List from Question and PQ
Best Answer Number
880 GET NP LIST FOR THE USER'S QUESTION
Receive the question from client 880A
Get the NP list using NLE 880B
815A Compare NP list
Compare NP of user's question with PQ from DB to find out the best suitable question present in the DB
Question
NP List
NP List of User's Question
NP List
Question
Paired Questions
900 INITIALIZE GROUPER RESOURCES
Initialize Token Resources 900A
Initialize Tagger Resources 900B
Initialize Grouper resources 900C
Create Grouper 900D
9b. Tokenize the words from the given text 909B
9c. Tag all the tokens 909C
9d. Group all tagged tokens to form the NP 909D
9E. UN-INITIALIZE GROUPER RESOURCES OBJECT AND FREE THE RESOURCES
Free token resources 909EA
Free tagger resources 909EB
Free grouper resources 909EC
NLE

Fig. 5

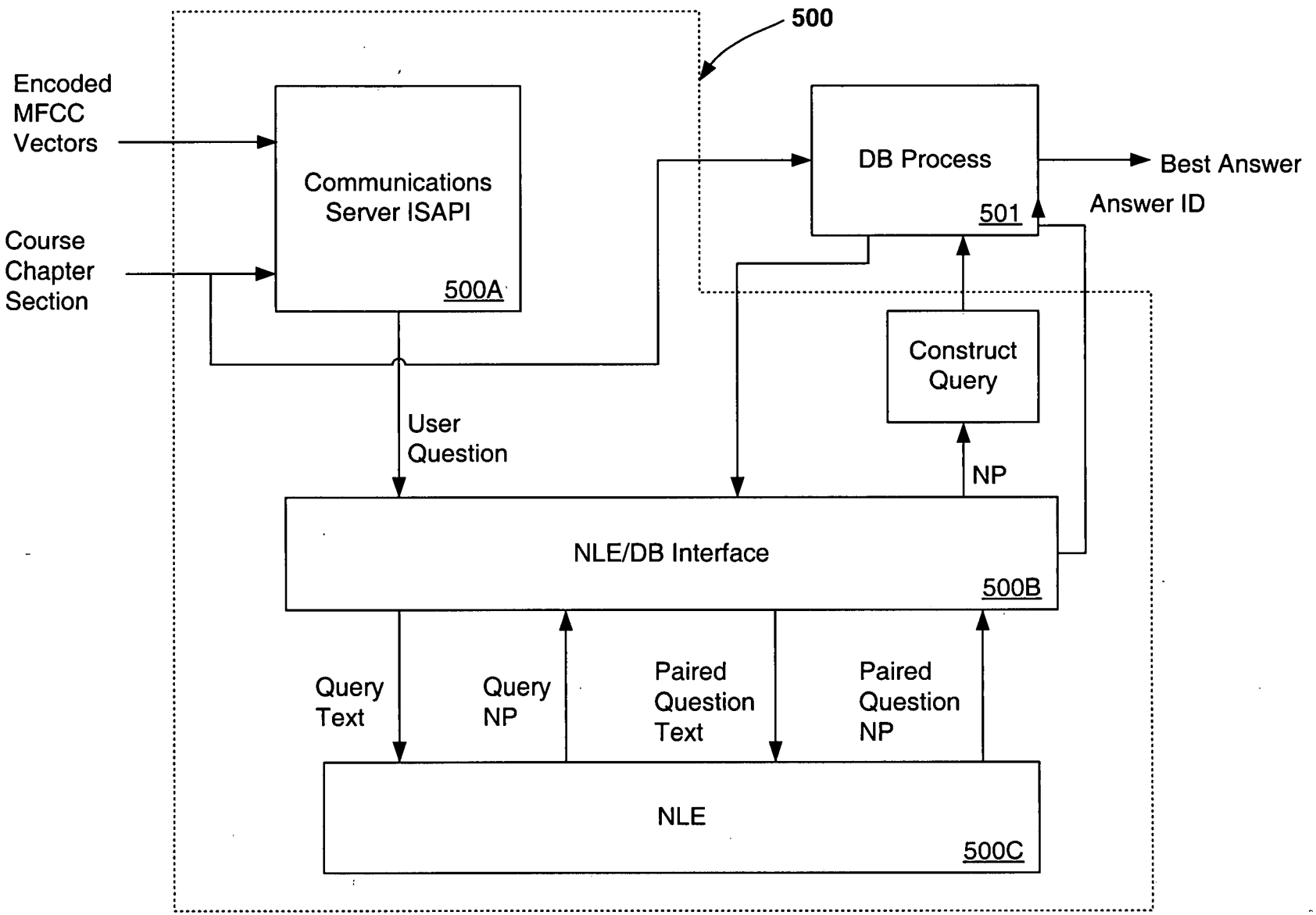

500
Encoded
MFCC
Vectors
Course
Chapter
Section
Communications
Server ISAPI
500A
DB Process
501
Best Answer
Answer ID
Construct
Query
User
Question
NP
NLE/DB Interface
500B
Query
Text
Query
NP
Paired
Question
Text
Paired
Question
NP
NLE
500C

Fig.6

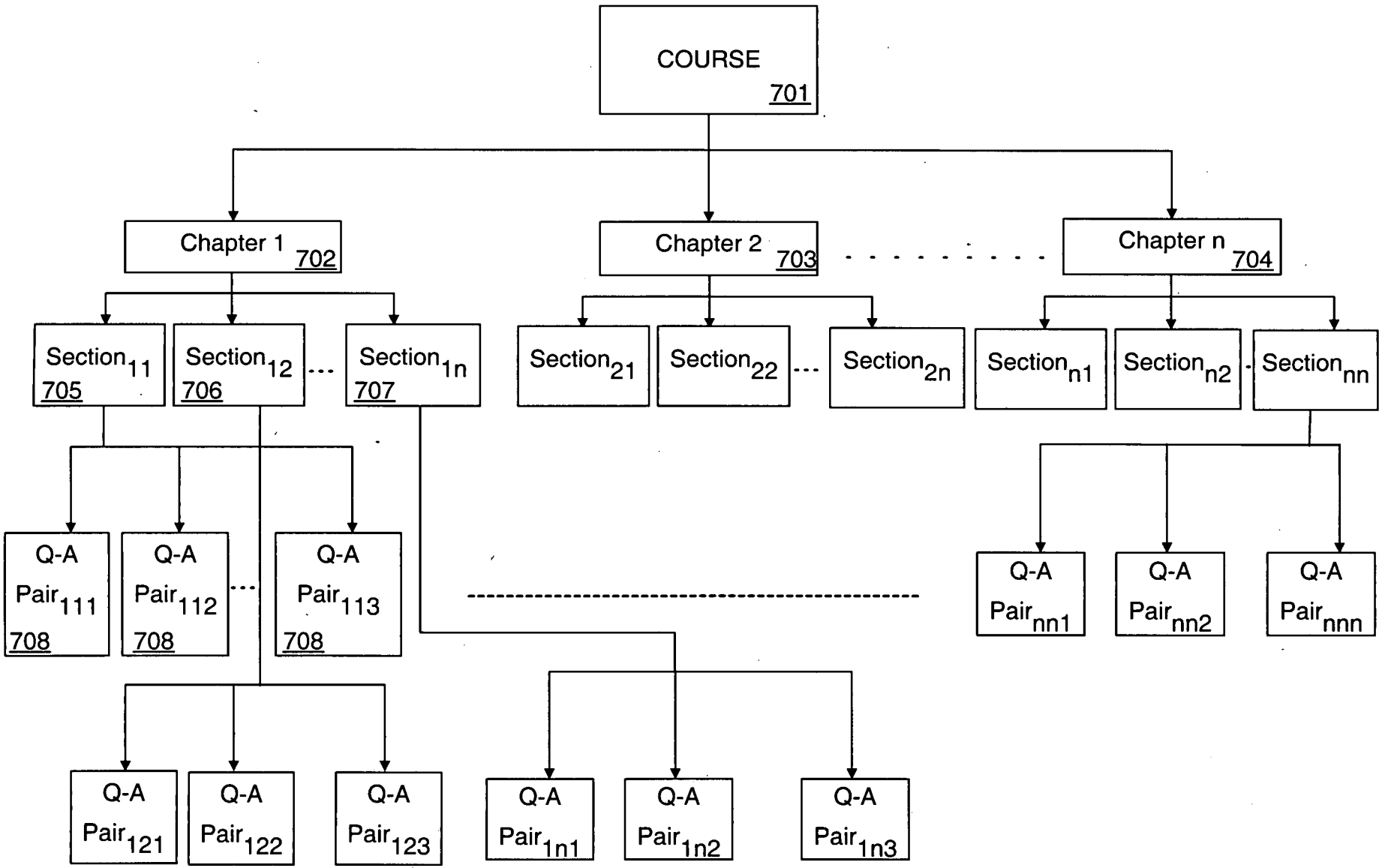

COURSE
701
Chapter 1
702
Chapter 2
703
Chapter n
704
Section11
705
Section12
706
Section1n
707
Section21
Section22
Section2n
Sectionn1
Sectionn2
Sectionnn
Q-A Pair111
708
Q-A Pair112
708
Q-A Pair113
708
Q-A Pairnn1
Q-A Pairnn2
Q-A Pairnnn
Q-A Pair121
Q-A Pair122
Q-A Pair123
Q-A Pair1n1
Q-A Pair1n2
Q-A Pair1n3

Fig.7A

FIELD NAME 701A	DATA TYPE 702A	SIZE 703A	NULL 704A	PRIMARY KEY 705A	INDEXED? 706A
ChapterName 707A	Varchar	255	No	No	Yes
SectionName 708A	Varchar	255	No	No	Yes

Fig.7B

FIELD NAME 720	DATA TYPE 721	SIZE 722	NULL 723	PRIMARY KEY 724	INDEXED? 725
Chapter_ID 726	Integer		No	Yes	Yes
Answer_ID 727	Char	5	No	UNIQUE	Yes
Section_Name 728	Varchar	255	No	UNIQUE	Yes
Answer_Title 729	Varchar	255	Yes	No	Yes
PairedQuestion 730	Text	16	No	No	Yes (Full-Text)
AnswerPath 731	Varchar	255	No	No	Yes
Creator 732	Varchar	50	No	No	Yes
Date_of_Creation 733	Date	-	No	No	Yes
Date_of_Modification 734	Date	-	No	No	Yes

Fig. 7C

Field 720	Description 735
AnswerID 727	An integer - automatically incremented for user convenience
Section_Name 728	Name of section to which the particular record belongs. This field along with AnswerID has to be made primary key
Answer_Title 729	A short description of the answer
PairedQuestion 730	Contains one or more combinations of questions for the related answer whose path is stored in the next column AnswerPath
AnswerPath 731	Contains the path of text file, which contains the answer to the related questions stored in the previous column
Creator 732	Name of content creator
Date_of_Creation 733	Date on which content has been added
Date_of_Modification 734	Date on which content has been changed or modified

Fig. 7D

FIELD 740	DATA TYPE 741	SIZE 742	NULL 743	PRIMARY KEY 744	INDEXED 745
Answer_ID 746	Char	5	No	Yes	Yes
Answer_Title 747	Varchar	255	Yes	No	No
PairedQuestion 748	Text	16	No	No	Yes (Full-Text)
Answer_Path 749	Varchar	255	No	No	No
Creator 750	Varchar	50	No	No	No
Date_of_Creation 751	Date	-	No	No	No
Date_of_Modification 752	Date	-	No	No	No

Fig. 8

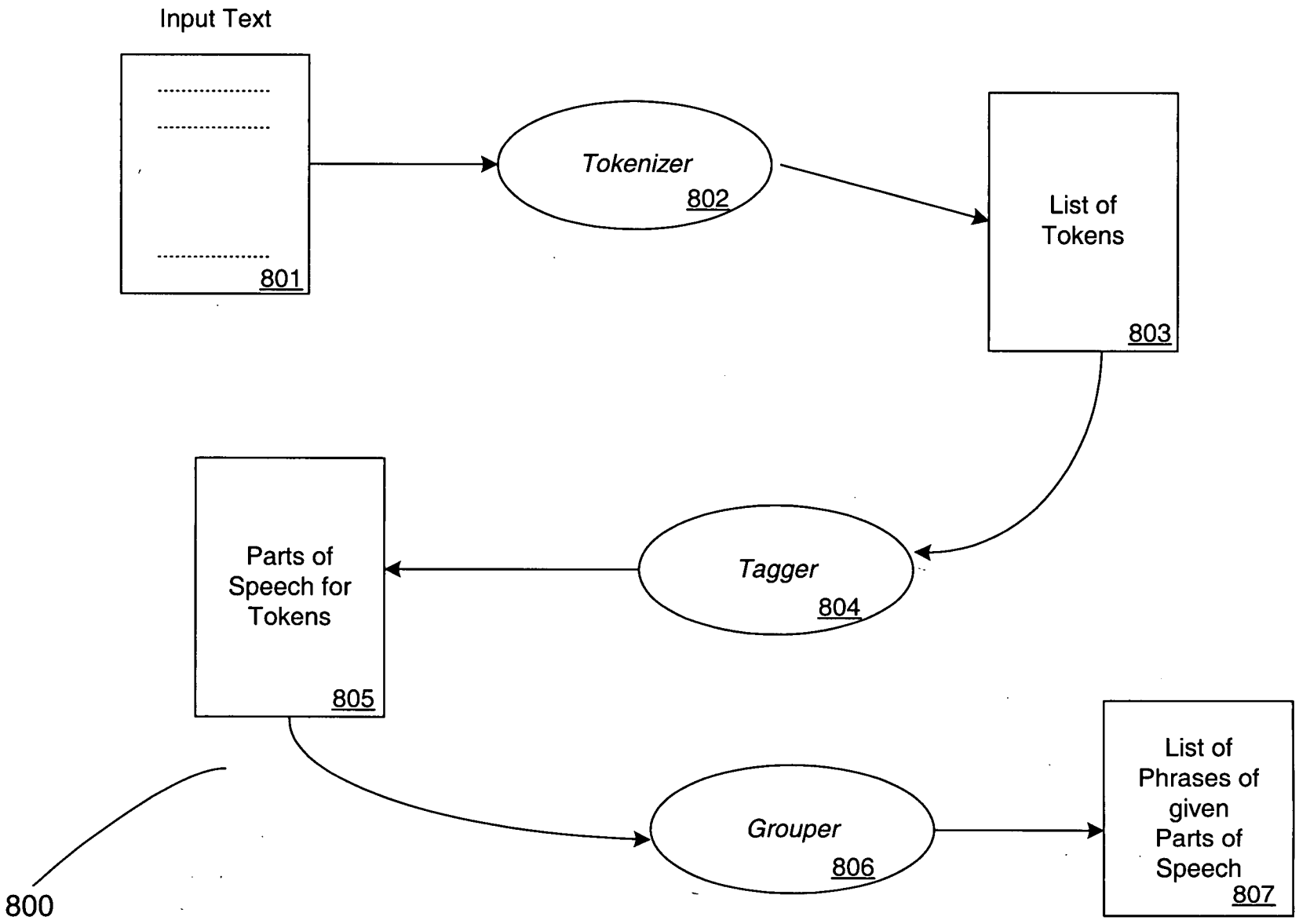

Input Text
801
Tokenizer
802
List of Tokens
803
Tagger
804
Parts of Speech for Tokens
805
Grouper
806
List of Phrases of given Parts of Speech
807
800

Fig. 9

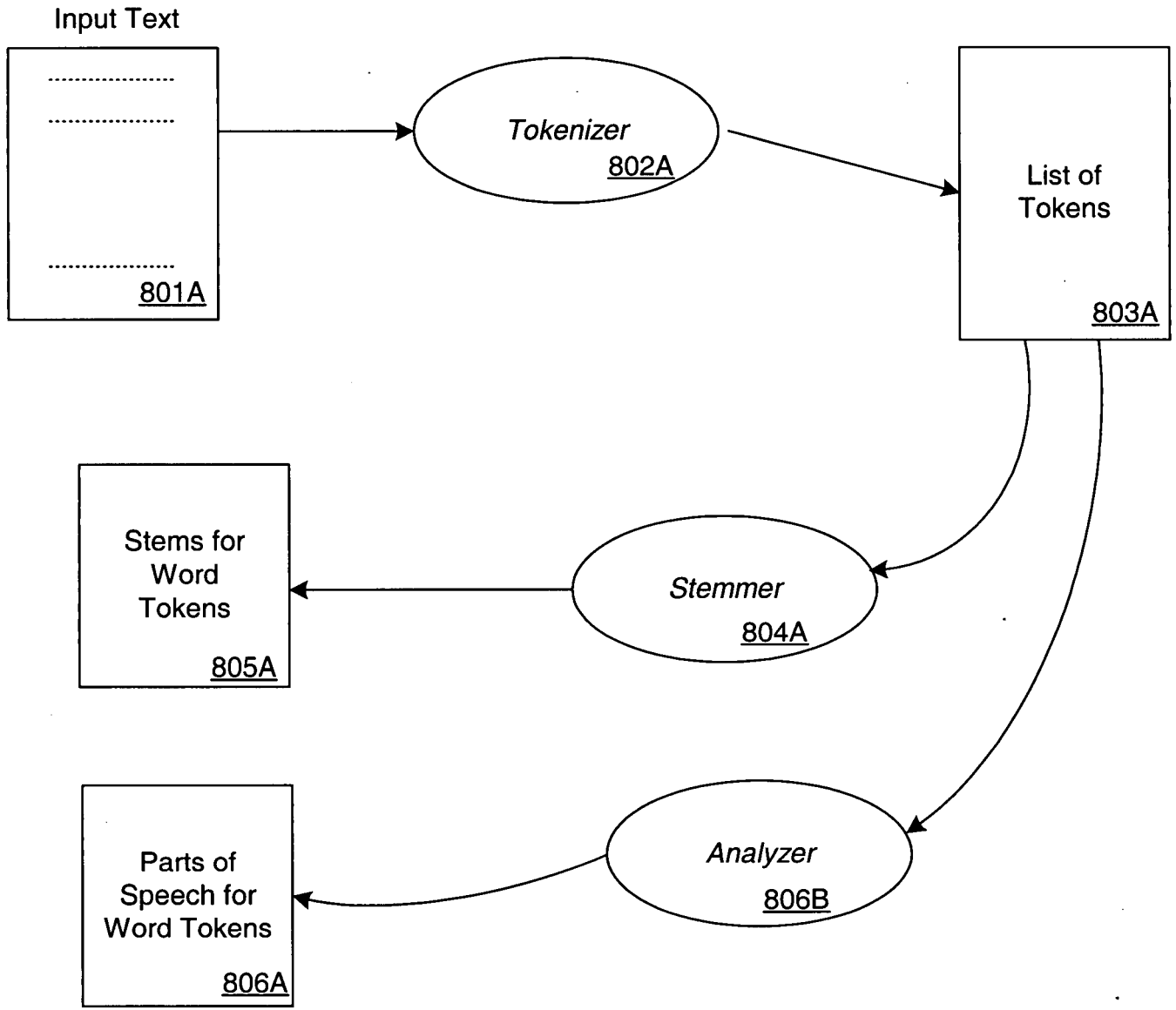

Input Text
801A
Tokenizer
802A
List of Tokens
803A
Stems for Word Tokens
805A
Stemmer
804A
Parts of Speech for Word Tokens
806A
Analyzer
806B

Fig. 10

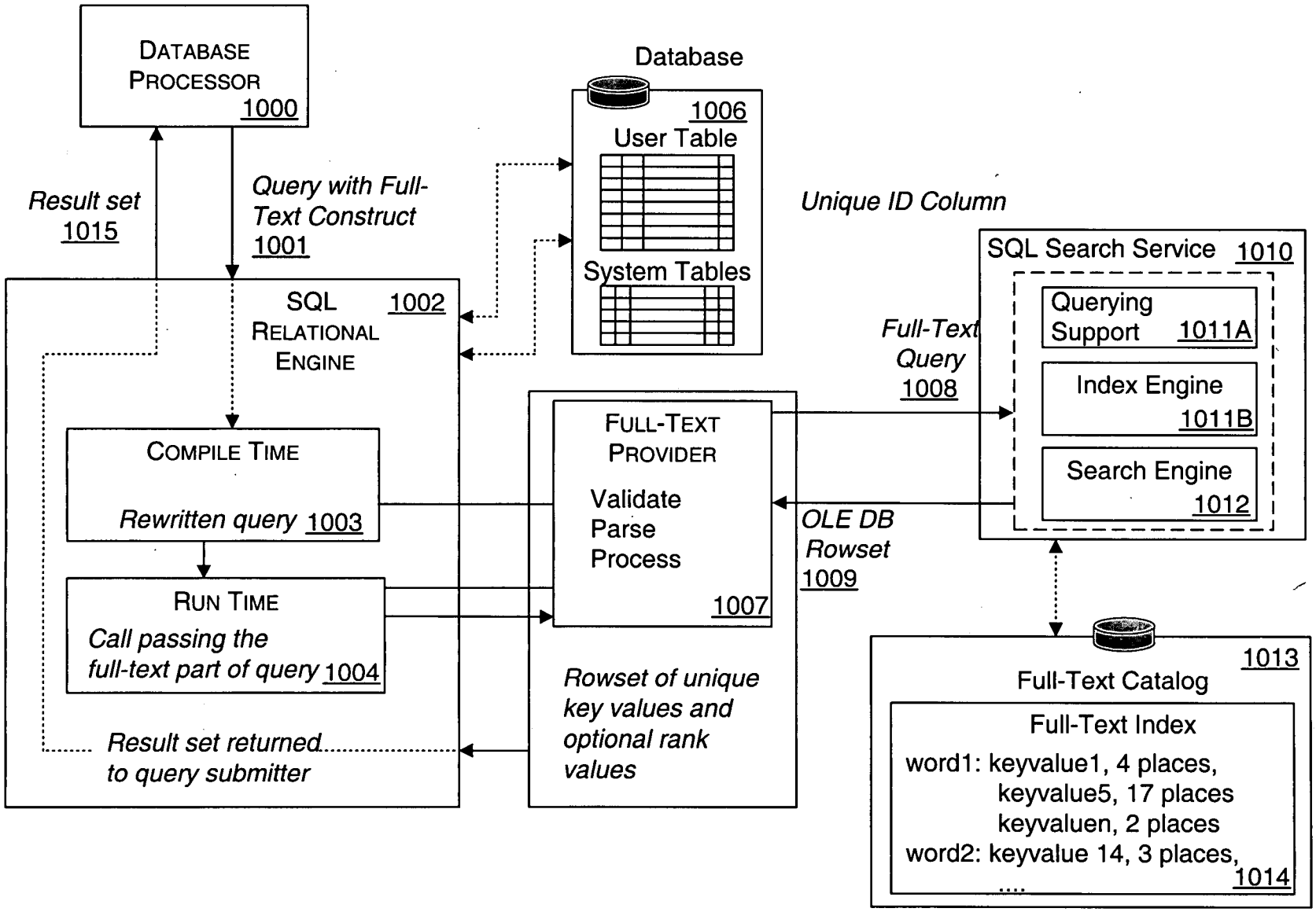

DATABASE PROCESSOR 1000
Database
1006
User Table
System Tables
Result set 1015
Query with Full-Text Construct 1001
Unique ID Column
SQL Search Service 1010
Querying Support 1011A
Index Engine 1011B
Search Engine 1012
SQL RELATIONAL ENGINE 1002
Full-Text Query 1008
COMPILE TIME
Rewritten query 1003
RUN TIME
Call passing the full-text part of query 1004
FULL-TEXT PROVIDER
Validate
Parse
Process
1007
OLE DB Rowset 1009
Rowset of unique key values and optional rank values
Result set returned to query submitter
1013
Full-Text Catalog
Full-Text Index
word1: keyvalue1, 4 places,
keyvalue5, 17 places
keyvaluen, 2 places
word2: keyvalue 14, 3 places,
....
1014

Fig. 11A

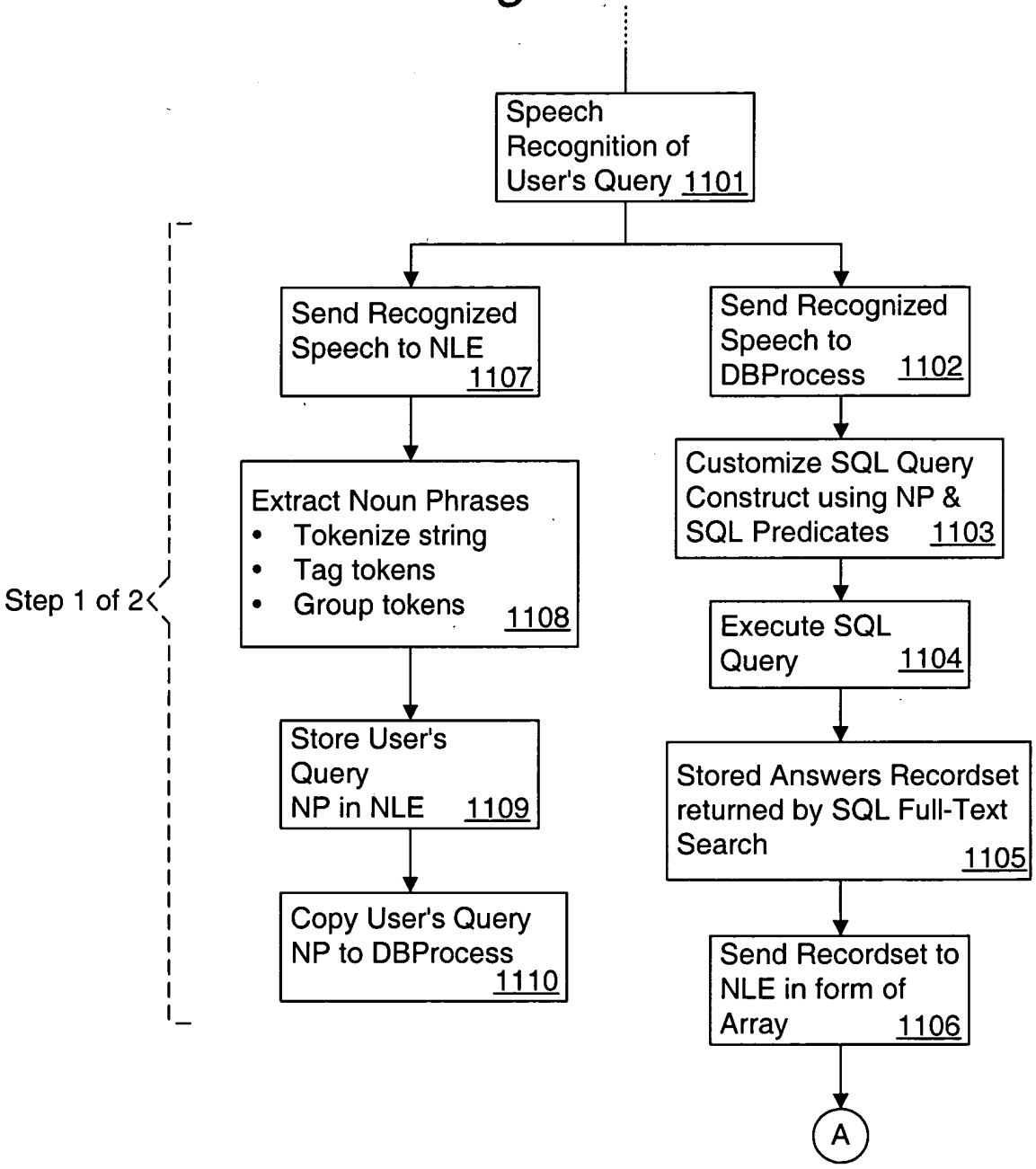

Speech Recognition of User's Query 1101
Send Recognized Speech to NLE 1107
Send Recognized Speech to DBProcess 1102
Extract Noun Phrases
• Tokenize string
• Tag tokens
• Group tokens 1108
Customize SQL Query Construct using NP & SQL Predicates 1103
Execute SQL Query 1104
Store User's Query NP in NLE 1109
Stored Answers Recordset returned by SQL Full-Text Search 1105
Copy User's Query NP to DBProcess 1110
Send Recordset to NLE in form of Array 1106
A
Step 1 of 2

Fig. 11B

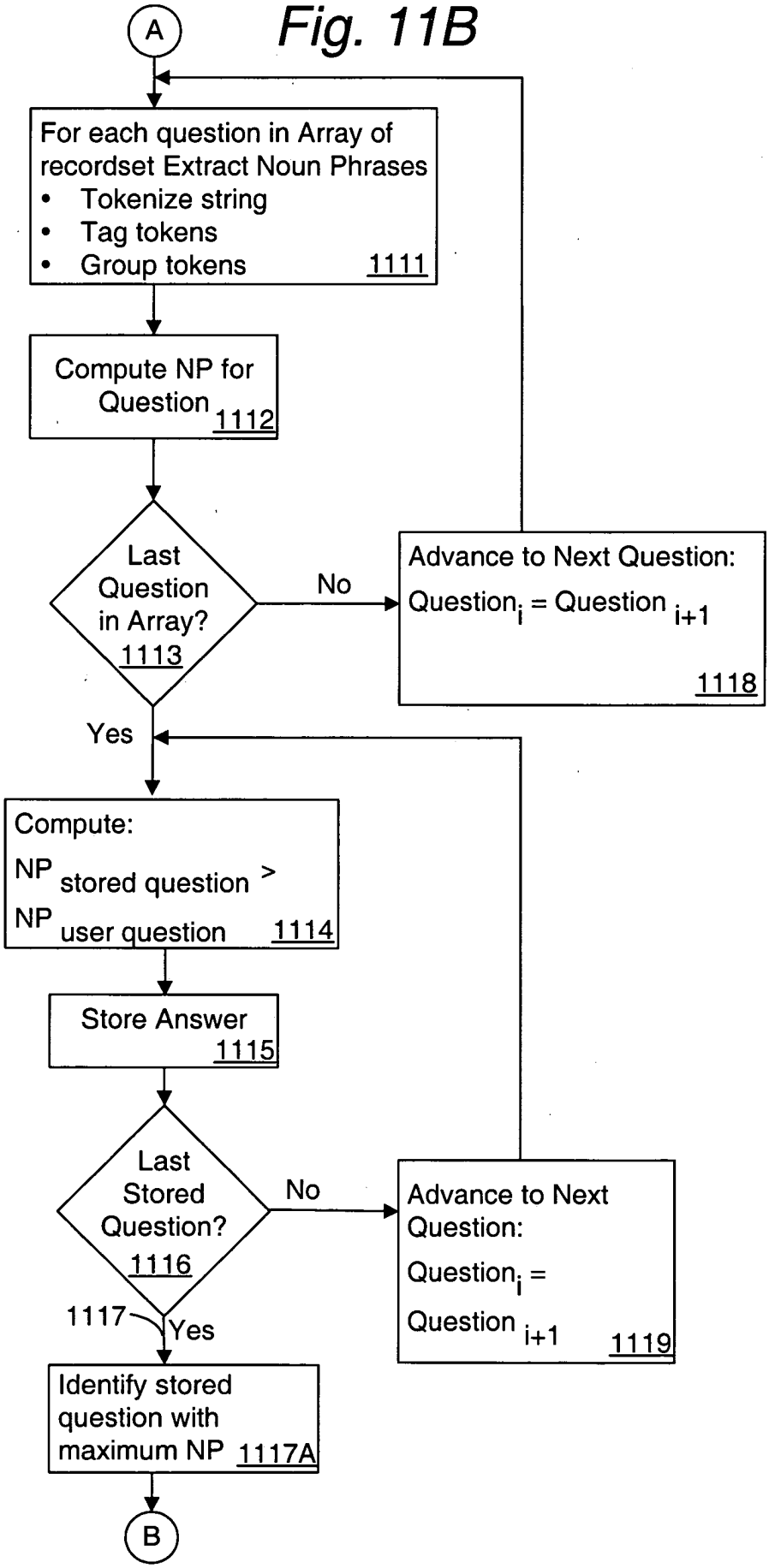

A
For each question in Array of recordset Extract Noun Phrases
• Tokenize string
• Tag tokens
• Group tokens
1111
Compute NP for Question
1112
Last Question in Array?
1113
No
Advance to Next Question:
Question$_i$ = Question $_{i+1}$
1118
Yes
Compute:
NP $_{\text{stored question}}$ >
NP $_{\text{user question}}$
1114
Store Answer
1115
Last Stored Question?
1116
No
Advance to Next Question:
Question$_i$ =
Question $_{i+1}$
1119
1117
Yes
Identify stored question with maximum NP
1117A
B

Fig. 11C

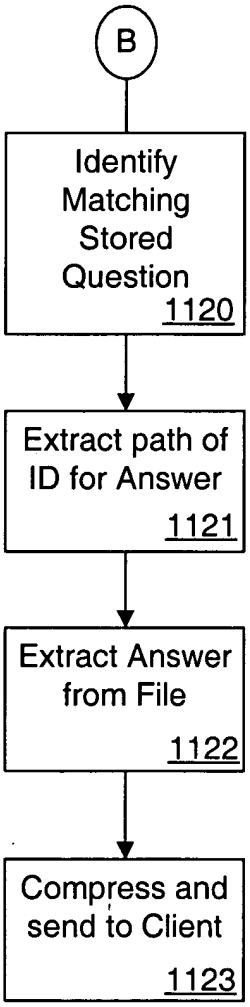

B
Identify Matching Stored Question
1120
Extract path of ID for Answer
1121
Extract Answer from File
1122
Compress and send to Client
1123

Fig. 12

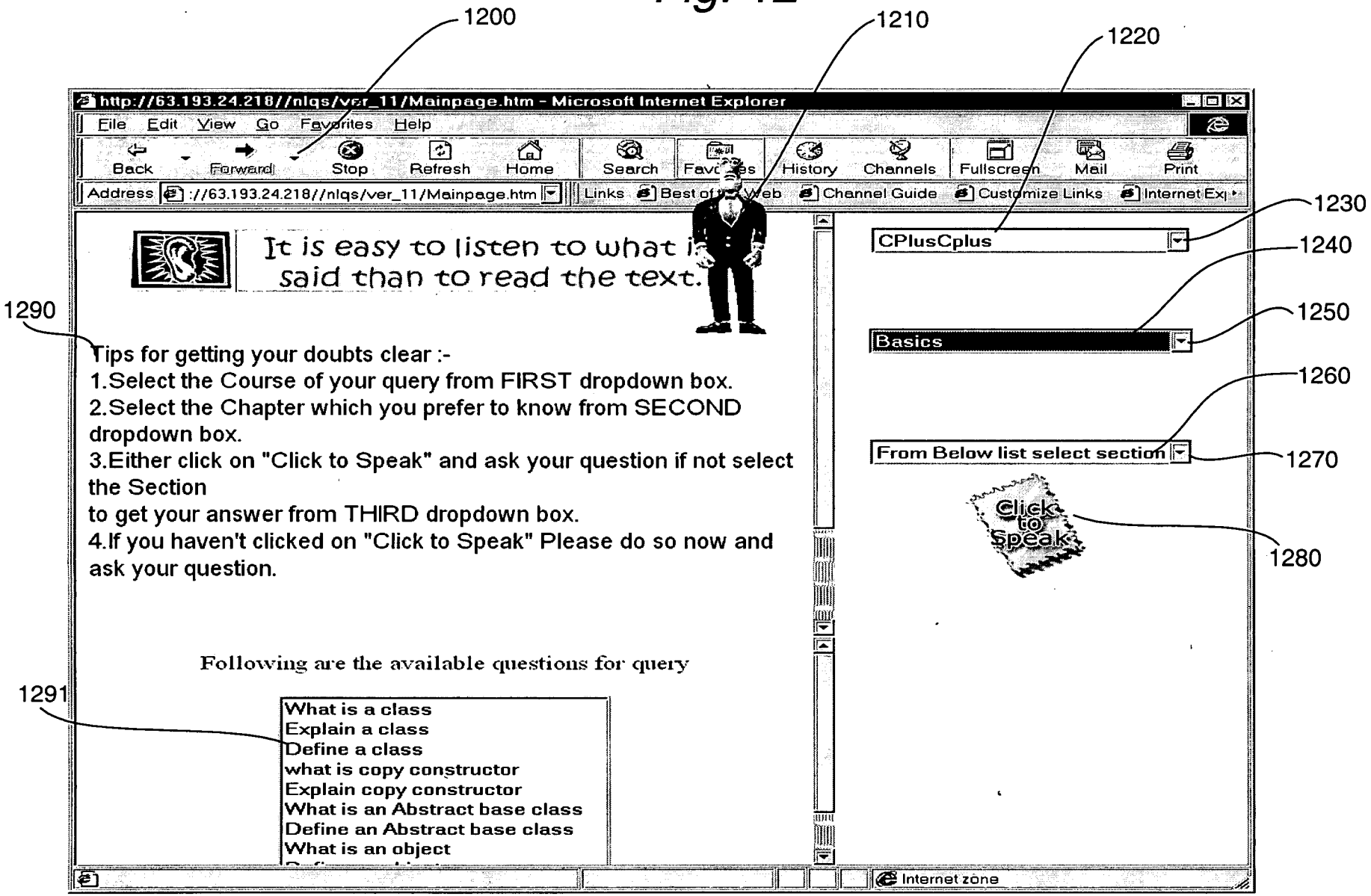

1200
1210
1220
1230
1240
1250
1260
1270
1280
1290
1291
http://63.193.24.218//nlqs/ver_11/Mainpage.htm - Microsoft Internet Explorer
File Edit View Go Favorites Help
Back Forward Stop Refresh Home Search Favorites History Channels Fullscreen Mail Print
Address ://63.193.24.218//nlqs/ver_11/Mainpage.htm
Links Best of the Web Channel Guide Customize Links Internet Ex
It is easy to listen to what i
said than to read the text.
CPlusCplus
Basics
From Below list select section
Click to Speak
Tips for getting your doubts clear :-
1.Select the Course of your query from FIRST dropdown box.
2.Select the Chapter which you prefer to know from SECOND dropdown box.
3.Either click on "Click to Speak" and ask your question if not select the Section
to get your answer from THIRD dropdown box.
4.If you haven't clicked on "Click to Speak" Please do so now and ask your question.
Following are the available questions for query
What is a class
Explain a class
Define a class
what is copy constructor
Explain copy constructor
What is an Abstract base class
Define an Abstract base class
What is an object
Internet zone

Fig. 13

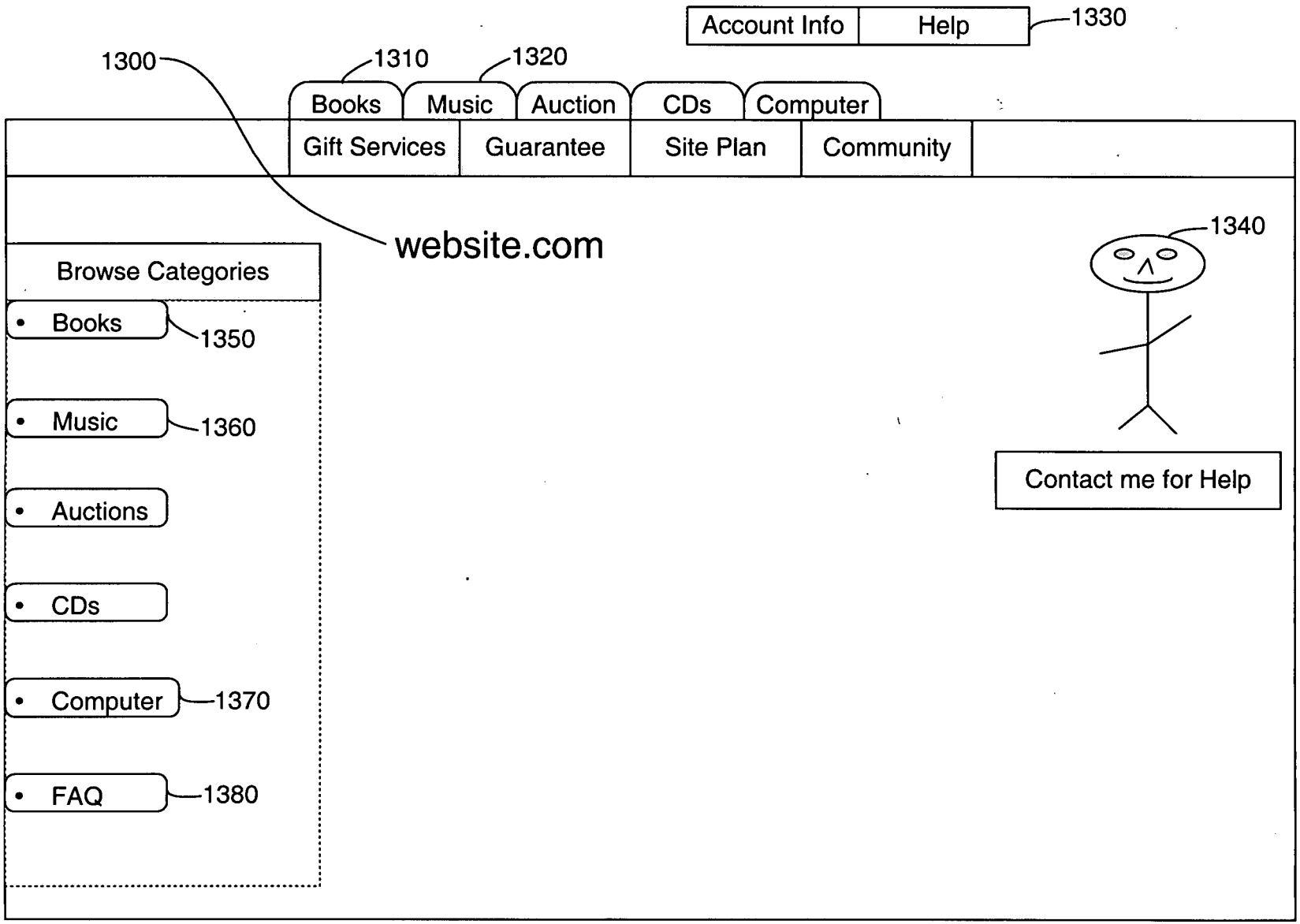

Account Info
Help
1330
1300
1310
1320
Books
Music
Auction
CDs
Computer
Gift Services
Guarantee
Site Plan
Community
website.com
1340
Browse Categories
Books
1350
Music
1360
Auctions
CDs
Computer
1370
FAQ
1380
Contact me for Help

Fig. 14

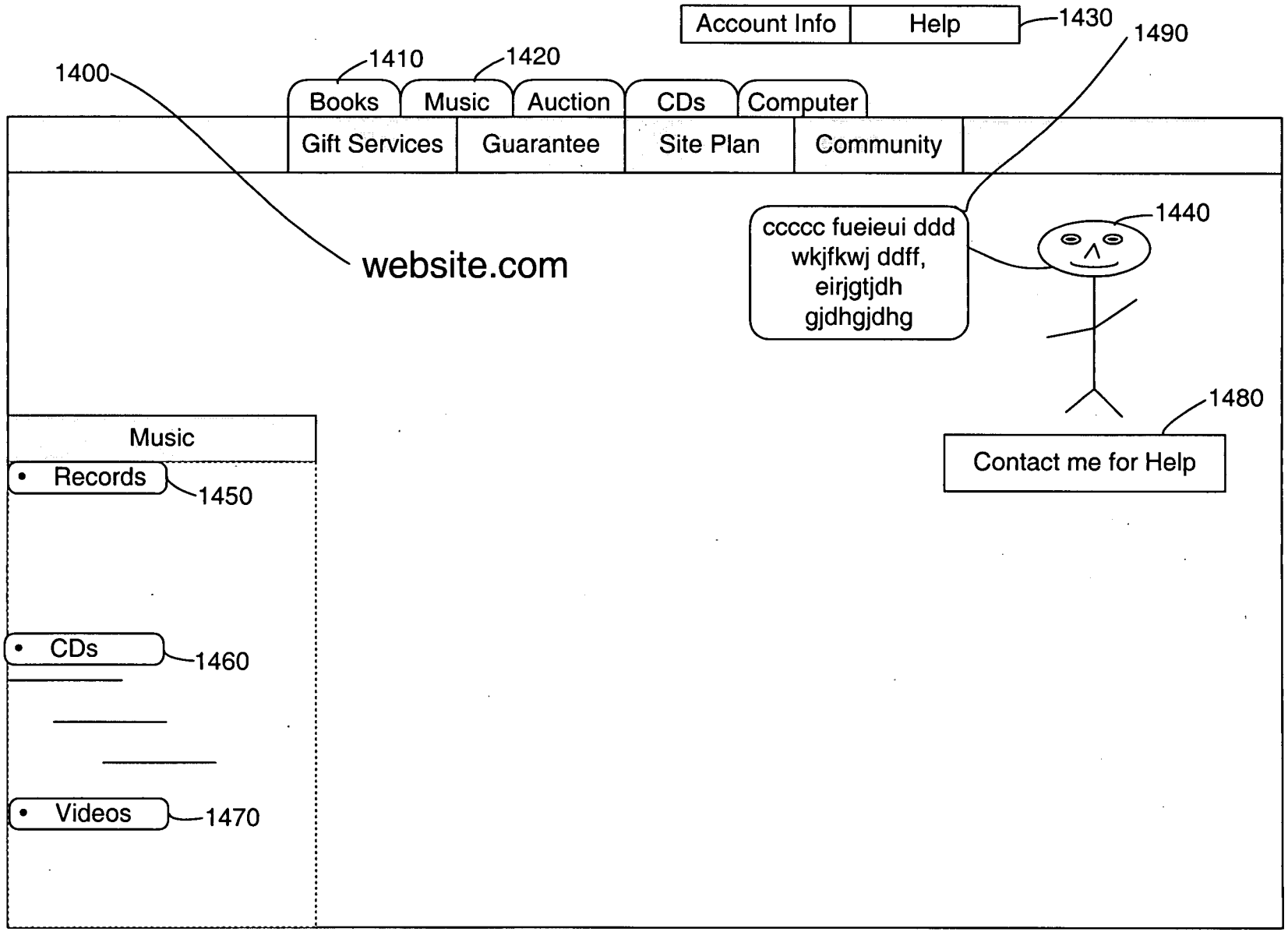

Account Info
Help
1430
1490
1400
1410
1420
Books
Music
Auction
CDs
Computer
Gift Services
Guarantee
Site Plan
Community
website.com
ccccc fueieui ddd wkjfkwj ddff, eirjgtjdh gjdhgjdhg
1440
1480
Contact me for Help
Music
Records
1450
CDs
1460
Videos
1470

Fig. 15

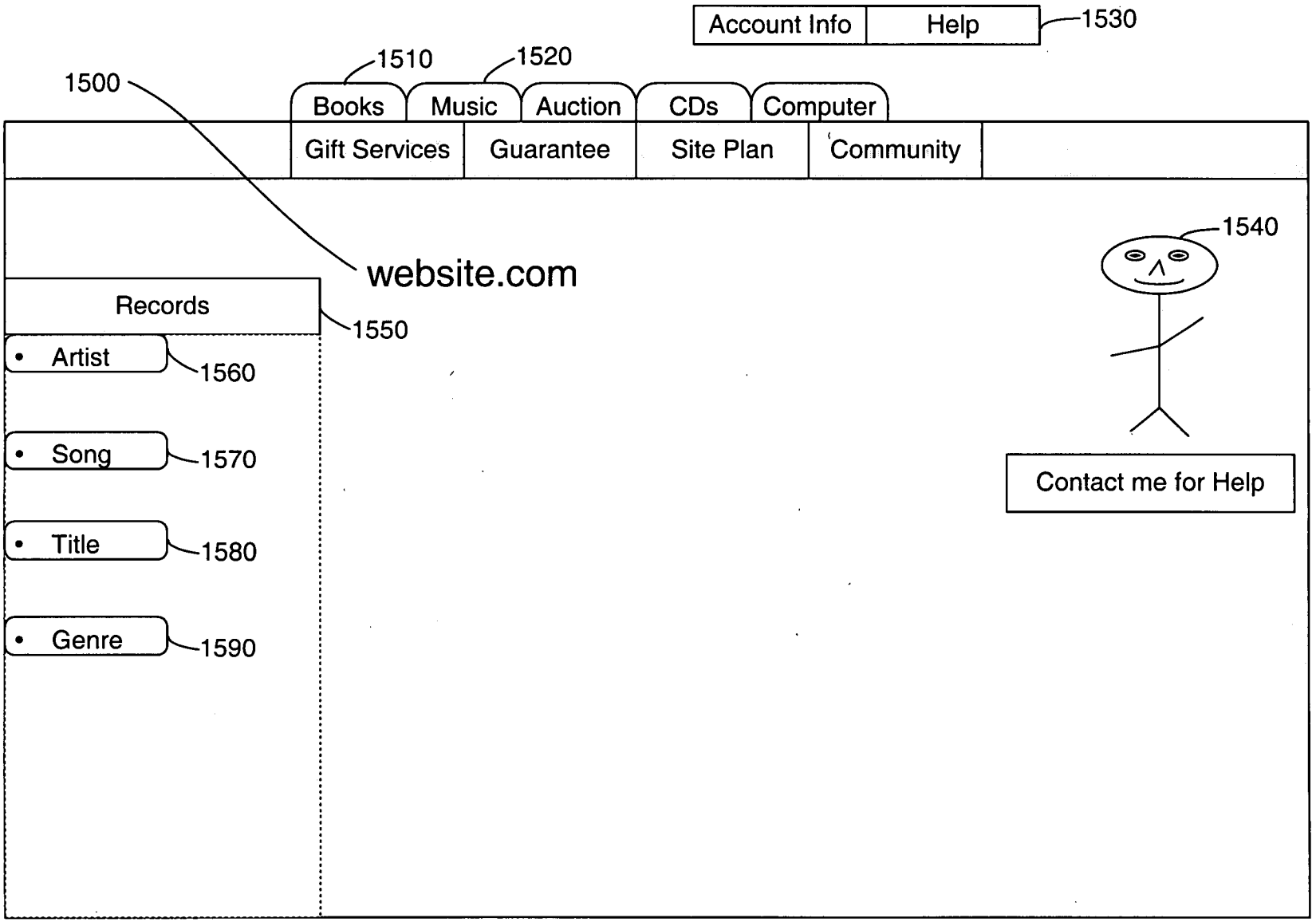

Account Info
Help
1530
1510
1520
1500
Books
Music
Auction
CDs
Computer
Gift Services
Guarantee
Site Plan
Community
website.com
1540
Records
1550
Artist
1560
Song
1570
Title
1580
Genre
1590
Contact me for Help

Fig. 16

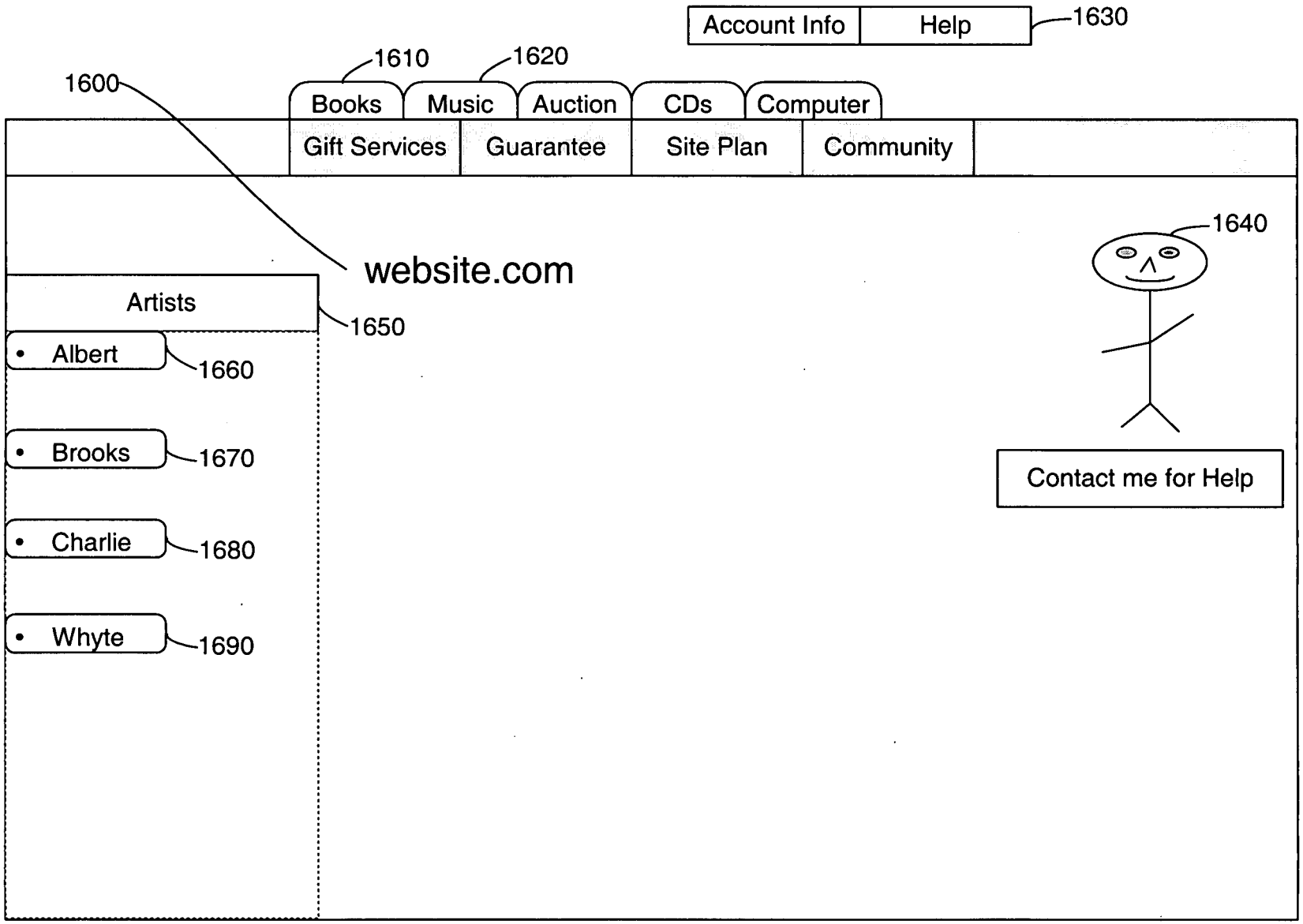

Account Info
Help
1630
1610
1620
1600
Books
Music
Auction
CDs
Computer
Gift Services
Guarantee
Site Plan
Community
1640
website.com
Artists
1650
• Albert
1660
• Brooks
1670
• Charlie
1680
• Whyte
1690
Contact me for Help

Fig. 17

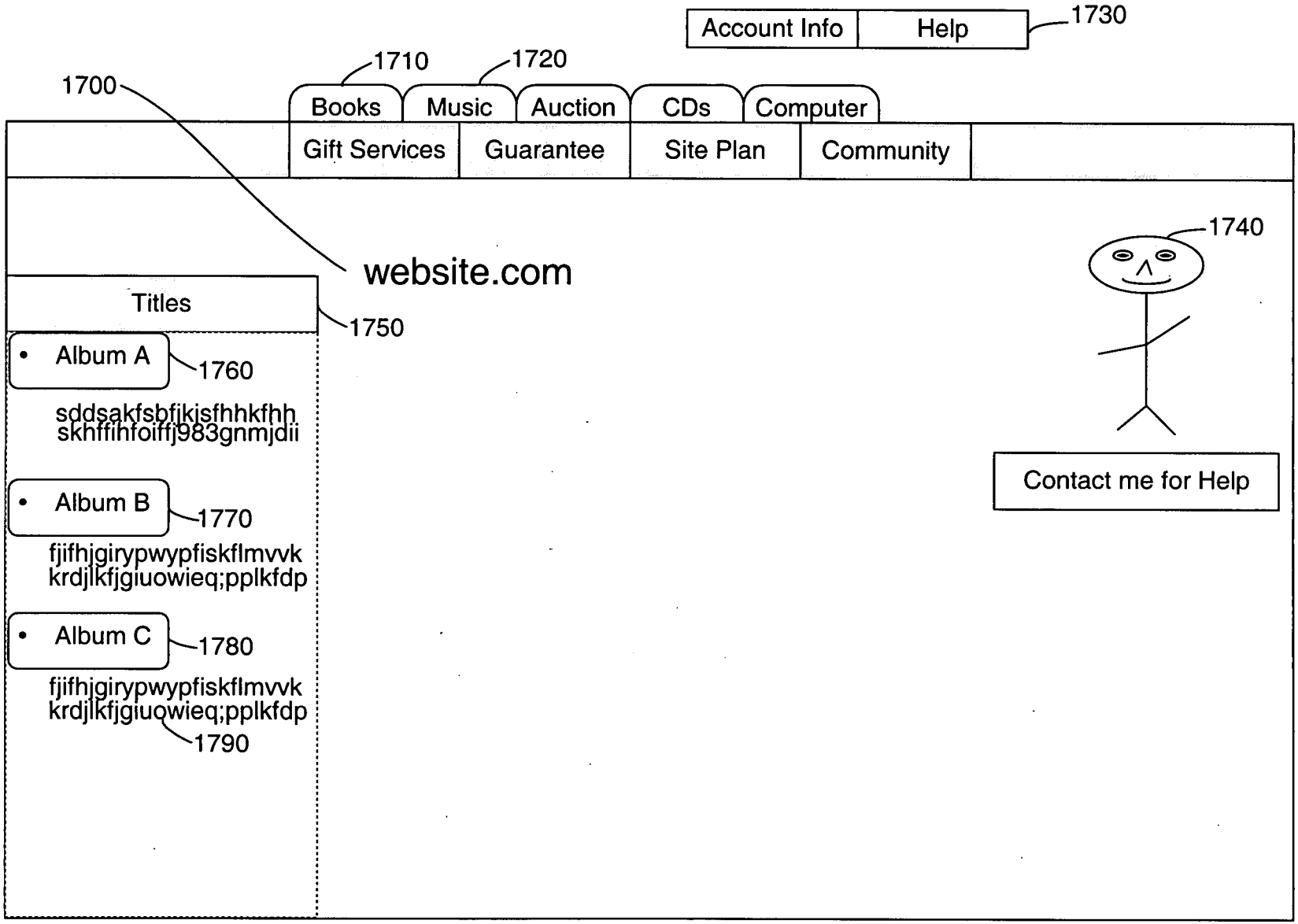

Account Info
Help
1730
1710
1720
1700
Books
Music
Auction
CDs
Computer
Gift Services
Guarantee
Site Plan
Community
1740
website.com
Titles
1750
• Album A
1760
sddsakfsbfjkjsfhhkfhh
skhffihfoiffj983gnmjdii
• Album B
1770
fjifhjgirypwypfiskflmvvk
krdjlkfjgiuowieq;pplkfdp
• Album C
1780
fjifhjgirypwypfiskflmvvk
krdjlkfjgiuowieq;pplkfdp
1790
Contact me for Help

Fig. 18A

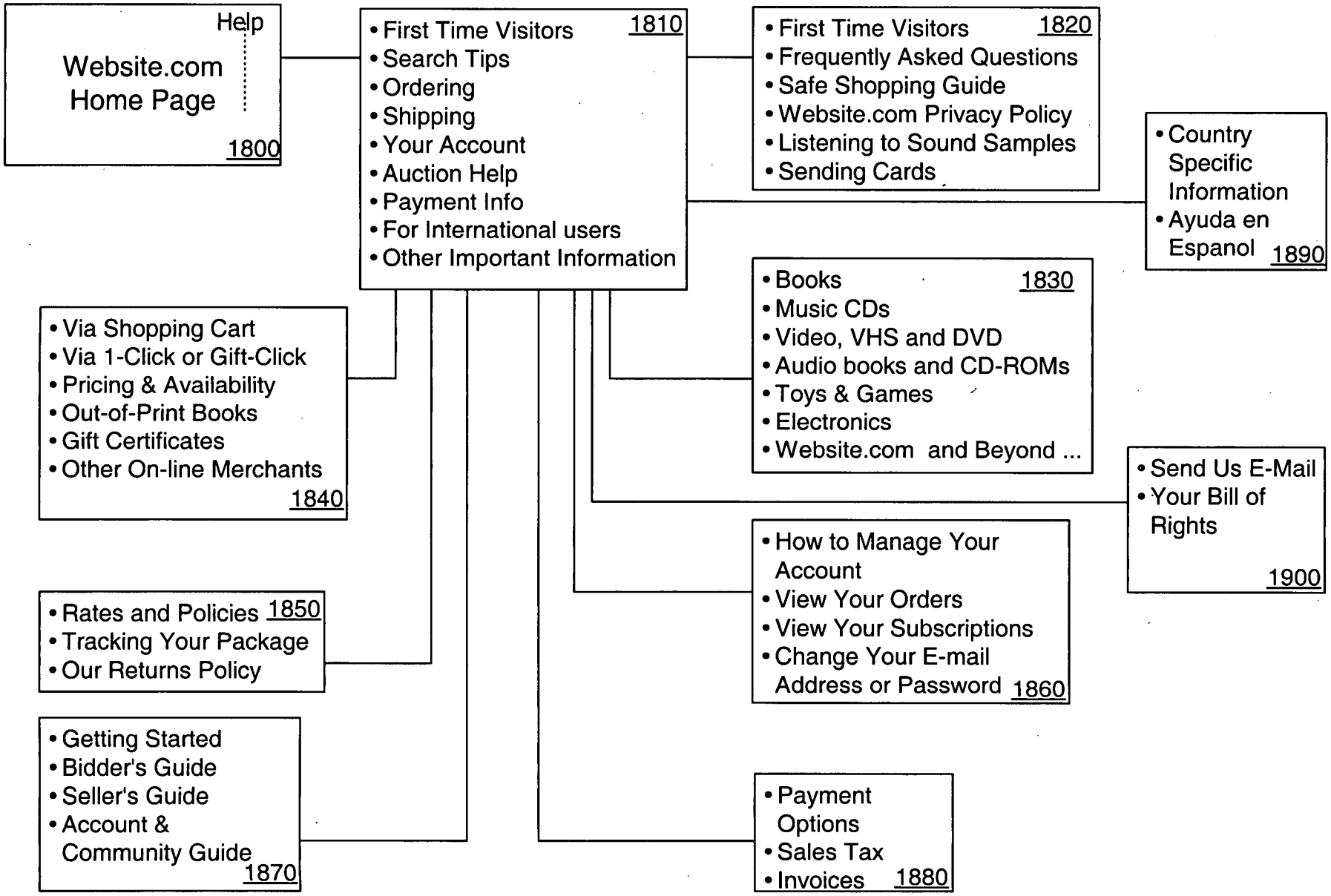
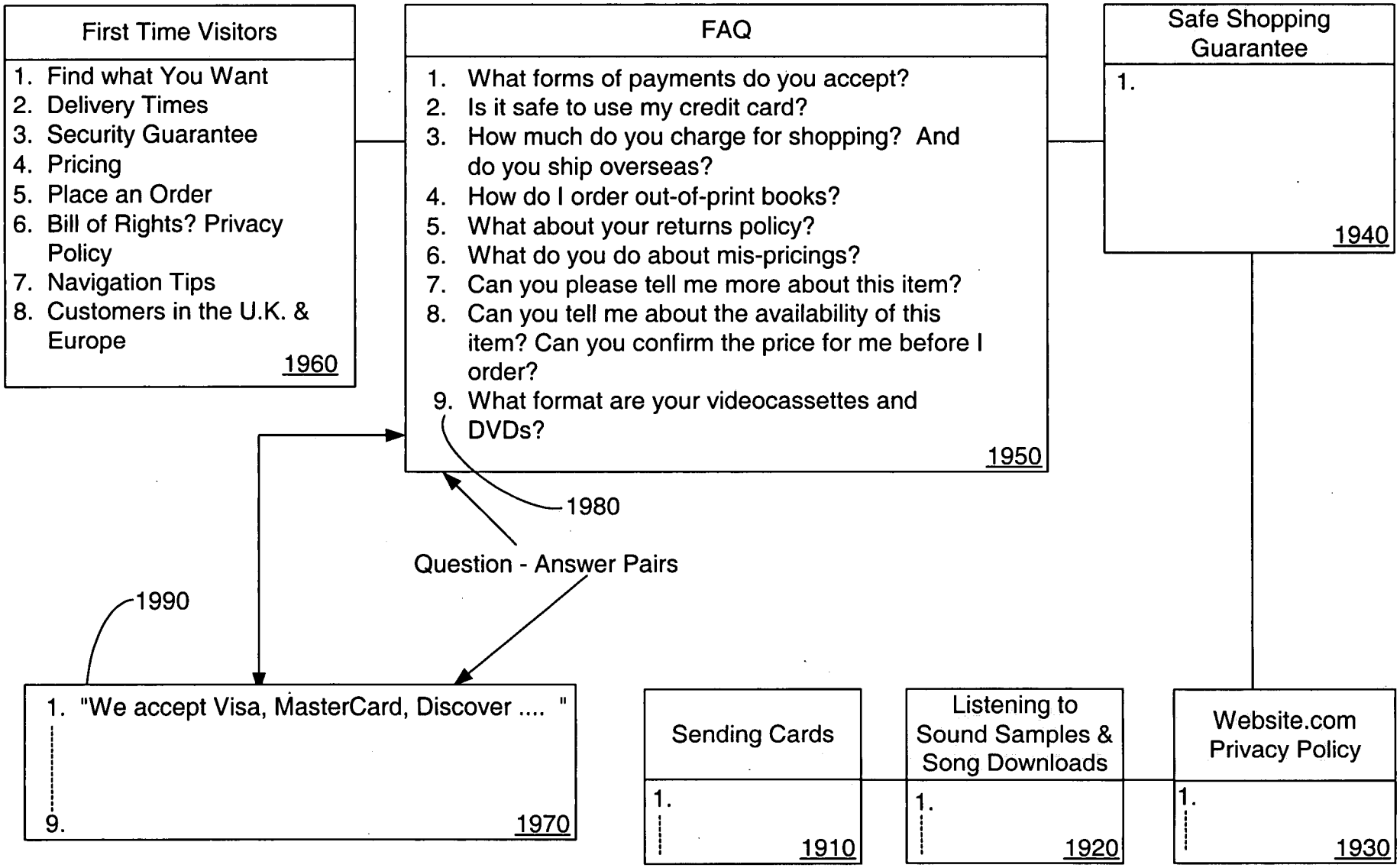

Help
Website.com
Home Page
1800
• First Time Visitors
• Search Tips
• Ordering
• Shipping
• Your Account
• Auction Help
• Payment Info
• For International users
• Other Important Information
1810
• First Time Visitors
• Frequently Asked Questions
• Safe Shopping Guide
• Website.com Privacy Policy
• Listening to Sound Samples
• Sending Cards
1820
• Country Specific Information
• Ayuda en Espanol
1890
• Via Shopping Cart
• Via 1-Click or Gift-Click
• Pricing & Availability
• Out-of-Print Books
• Gift Certificates
• Other On-line Merchants
1840
• Books
• Music CDs
• Video, VHS and DVD
• Audio books and CD-ROMs
• Toys & Games
• Electronics
• Website.com and Beyond ...
1830
• Send Us E-Mail
• Your Bill of Rights
1900
• How to Manage Your Account
• View Your Orders
• View Your Subscriptions
• Change Your E-mail Address or Password
1860
• Rates and Policies
• Tracking Your Package
• Our Returns Policy
1850
• Getting Started
• Bidder's Guide
• Seller's Guide
• Account & Community Guide
1870
• Payment Options
• Sales Tax
• Invoices
1880

Fig. 18B


First Time Visitors
1. Find what You Want
2. Delivery Times
3. Security Guarantee
4. Pricing
5. Place an Order
6. Bill of Rights? Privacy Policy
7. Navigation Tips
8. Customers in the U.K. & Europe
1960
FAQ
1. What forms of payments do you accept?
2. Is it safe to use my credit card?
3. How much do you charge for shopping? And do you ship overseas?
4. How do I order out-of-print books?
5. What about your returns policy?
6. What do you do about mis-pricings?
7. Can you please tell me more about this item?
8. Can you tell me about the availability of this item? Can you confirm the price for me before I order?
9. What format are your videocassettes and DVDs?
1950
Safe Shopping Guarantee
1.
1940
1980
Question - Answer Pairs
1990
1. "We accept Visa, MasterCard, Discover .... "
9.
1970
Sending Cards
1.
1910
Listening to Sound Samples & Song Downloads
1.
1920
Website.com Privacy Policy
1.
1930